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VIEWS, NEWS AND INTERVIEWS.

One of the smallest offices in New York city is that occupied by an electrical contracting firm in the Havemeyer building. The office is four feet wide and eight feet long. But there is not in the arrangement of desks and furniture an inch of waste space. Even the electric radiator which heats it is small and out of the way. It is reported that in these lilliputian quarters the firm does a business of $75,000 a year.

The DeLaval process for electrical extraction of metal from the ore is being practically applied at Trollhättan, Sweden, where a waterfall has been secured for the purpose. The experiments have hitherto been confined to Grängesberg ore, but will, it is understood, soon be extended to the iron ore from the vast deposits in North Sweden. It is expected in some quarters that De Laval's invention will revolutionize the Swedish iron industry. The process is said to be both simple and cheap when water-power is available, and is already attracting much attention.

The Consolidated Gas Company has introduced in New York city a pay-before-you-burn gas meter, modeled on the principle of the familiar nickel in-a-slot machine. The meter is chiefly for the use of persons whose scanty incomes oblige them to buy everything in small quantities. The meter will, accordingly, be placed in tenements, although any gas consumer who wants one may have it. The meter has been in use in England for some time. It was introduced to popularize the use of gas among the poor. There the dropping of a penny (two cents) in the slot sets the gas going. Here a quarter is to be used to produce this effect. This will pay for 200 feet of gas, sufficient to supply a four foot burner 50 hours. If the consumer wants to pay all at once for more than that supply of gas, all he has to do is to drop in a proportionate number of quarters. Five quarters, for example, will pay for 1,000 feet of gas. The quarter-in-a slot gas meter is constructed like an ordinary meter, so far as measuring the gas is concerned, with a metal addition at the side having a slot big enough for a quarter, and containing the machinery which regulates the movement of the hand controlling the supply of gas. The dropping in of a quarter sets this hand in motion, and when the hand has reached the 200 feet limit, it goes back to the starting point and cuts off the gas.

A gentleman who has been engaged in the patent bureau for the last 40 years, who has been an examiner in the Patent Office and who is now one of the foremost attorneys practicing before it, in speaking of the revolutionary methods adopted by Commissioner Seymour, is reported by the Washington correspondent of the Chicago *Record* as saying: "The Commissioner evidently came into office with the idea that he should reform practices and revolutionize matters generally, and with that object in view he has withdrawn somewhere between 600 and 700 cases that had been allowed and were ready to go to issue. Two of these cases have been carried to the courts upon an application for mandamus to compel him to issue the patents. Inasmuch as the final fees in these cases have not been paid the government is deprived of between $12,000 and $14,000 revenue. In addition to this he has instructed examiners that patents shall not be granted for slight improvements, and that no patent shall be granted that will infringe upon any existing patent. If this decision is enforced a great hardship will be inflicted upon deserving inventors, and the spirit of progress which has marked the history of this country will be almost entirely retarded. A thousand instances could be cited where such a policy would have deprived the people of valuable inventions which are now to be found in nearly every household."

E. R. WEEKS, 1890. S. A. DUNCAN, 1889. J. FRANK MORRISON, 1885-88.

THE FIRST THREE PRESIDENTS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION—FROM A PHOTOGRAPH TAKEN IN FRONT OF THE ELECTRIC CLUB, NEW YORK, AUGUST 31ST, 1888—A TRIO OF HARD-WORKING PIONEERS.

A correspondent of the Denver *Times* suggests that the gas, electric light and telephone companies of that city dress their employés in uniform so as to prevent the many sneak thieves from entering houses under the pretense of looking at the meter or telephone.

A Cincinnati man, A. H. Kisinger, has devised a novel scheme to keep trespassers off his 200 acre farm, near Bantam, Clermont County, O. About a year ago he brought several hundred dozen quails and squirrels from the West and turned them loose on his farm. He posted his farm to keep the hunters out, but they swarmed upon his place and killed not only the quails and squirrels but a fine lot of turkeys, and wounded a valuable horse which he had imported from Scotland. This was too much for Kisinger, who is now erecting a six foot fence around and through his place. On the fence he is stringing five strands of wires, so that neither dog nor man can get through or over the fence without touching one of the wires, which are to be heavily charged with electricity, and will give a severe shock to the person touching them. A large dynamo, run by an engine, has been placed in a small building on the farm to furnish the necessary current for the wires. He made a test a few days ago on a small part of the fence, which is completed, and found that dogs once shocked by the wires would not go near the fence.

The most profitable street railway in the world is the Broadway cable in New York, which is now said to be earning 50 cents per car mile, the biggest record ever made by a street railway company. It is understood that it is operated for one-third the gross on its very large earnings. The Brooklyn Street Railway Company has downed the elevated road in the City of the Churches by the introduction of the trolley, and it is now reported to be a serious question as to what will be done with the elevated structures.

WASHINGTON, AHOY!

President Cleveland will Receive President Armstrong and his Electric Light Disciples Wednesday Afternoon.

CONGRESSMEN INTERESTED IN THE CONVENTION AND WILL ATTEND—THE LECTURE BY STIERINGER AND MARTIN ON "THE WORLD'S FAIR" OPEN ONLY TO THOSE OBTAINING INVITATIONS—ADDITIONAL NAMES OF EBBITT HOUSE GUESTS—SEVERAL NEW PAPERS TO BE READ AT THE CONVENTION—THE EARNEST GENTLEMEN REPRESENTING MANUFACTURING COMPANIES—LARGE CROWDS FROM BOSTON, NEW YORK AND CHICAGO—THE RAILROAD RATE PROVING ATTRACTIVE TO THE ELECTRIC LIGHT DELEGATES AND MANY FAMILY PARTIES FORMED TO VISIT WASHINGTON—THE EXPRESSIVE COUNTENANCES OF THE PRESIDENTS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION PRESENTED TO OUR READERS.

THE LATEST CONVENTION NEWS.

President Cleveland has arranged for a reception to the electric light visitors at the White House, Wednesday, February 28, at 1.15 P. M.

Congressmen Durborow and Shaw, both well known to the electrical fraternity, have received special invitations to the Convention, and have notified Secretary Porter that they will be present.

Attendance at the stereopticon lecture on the World's Fair by Messrs. Stieringer and Martin, will be by invitation, delegates, of course, being the first to receive the necessary cards of admission.

"Faults Incident to the Protection of Light and Power Circuits," by Lucius T. Stanley and Walter E. Harrington, is the title of an interesting paper which has been added to the programme.

Ex-President Charles R. Huntley has promised to read a valuable report on "Electric Light Tests at Buffalo, N. Y."

The Washington Committee on Entertainment is composed of Messrs. Samuel M. Bryan, F. W. Royce, F. H. Clark, M. D. Law, and other electrical men of that city.

The advance guard of the National Electric Light Convention reached Washington last Wednesday. Among the early arrivals at the Ebbitt House were L. B. Marks and A. L. Searles, of New York, who landed in the midst of a gathering of the Daughters of the Revolution. Last week the ladies held full sway at the Ebbitt, this week the electric illuminators will have possession. Indications are that a very large number will be in attendance. Many more rooms have been engaged than the hotel manager anticipated, but he is setting his house in order so as to entertain all who come. The following have been booked since our last report:

Romaine Mace and wife, New York; Mr. and Mrs. Little, New York; C. R. Price, New Bedford; Harry Adams and wife, New York; I. H. Davis, Boston; N. H. Bryan, Louis Cassier, L. F. Howard and wife, New York; L. B. Marks, New York; Fremont Wilson, Mr. Van Gieson, New York; Henry B. Cutter, Philadelphia; J. G. Biddle, Queen & Co., Philadelphia; H. M. Davis, New York; A. L. Searles, New York; F. B. Parsons, Boston; F. H. Brady, New Britain; H. H. Fairbanks, Worcester; A. P. Seymour, Syracuse; J. C. Perriez, New York; delegation of eight gentlemen from the Westinghouse Electric and Manufacturing Co., Pittsburgh; W. S. Barstow, Brooklyn; M. Kester, of Electric Construction and Supply Co.; J. M. Orford and wife, Boston; A. J. Purinton, Stamford, Ct.; A. M. Young, wife and two daughters, Waterbury, Ct.; E. A. Scott, Philadelphia; Frank S. DeRonde, New York; E. P. Atkinson, New York.

The committee is considering a plan for having the Association photographed in a group on the portico of some public building. If any delegate takes a sweetheart with him, or finds one while in Washington, and does not wish to stand up beside her in broad daylight to be photographed, he can drop in at Clinedinst's, 1207 F street, two squares from headquarters, any time between 2.30 and 10 P. M., and have a picture taken by electric light. An outfit of new and very successful electric photographic apparatus is in operation there, and is worth seeing.

Mr. Royce is in correspondence with a number of exhibitors, and is arranging the details of that part of the affair. There is every prospect that a very fine exhibition will be made.

Most of the street railroads will give complimentary passes over their lines to members of the Association during their stay in the city.

The Metropolitan road is making an effort to get authority from Congress to equip its lines with the Low conduit system, which has received strong endorsements. The ELECTRICAL REVIEW's report of the Metropolitan company's experiments with storage batteries, which was liberally quoted in the Washington papers, caused much surprise even among persons who have been regularly traveling on the road. The work done by the company has been carried forward with so little publicity that no one dreamed of its magnitude until the facts were given in the REVIEW. Mr. Geo. C. Maynard, Washington correspondent of the ELECTRICAL REVIEW, writes that since Mr. Wm. Bracken, in his communication printed in the issue of February 7, has undertaken to convey the impression that the report was written carelessly and without an intelligent understanding of the case, it may be well to say that the information was obtained from the officials of the road who personally conducted the experiments, and that they have declared that the report, as published, is entirely correct in every particular. When Mr. Bracken attempts to question the integrity of Mr. Pearson, or the ability and faithfulness of Mr. Chamberlain, he makes a mistake. No men ever labored more energetically and persistently in any cause than those gentlemen did in their endeavors to successfully operate the cars of the Metropolitan road with storage batteries. When Mr. Bracken's batteries were on trial the road was completely equipped with Thomson-Houston motors and dynamos, and all the appliances were of the best kind obtainable. The trials were made strictly in accordance with detailed written instructions given by Mr. Bracken's company, and under the personal supervision of his very competent electrical expert, Mr. J. R. Williams. The trials were continued daily from January 8 to August 15, 1893, a period of more than seven months. During that time the accumulators were never capable of running a car for a full day's work. At the close of the trial they were worthless, and the experiment was a conspicuous failure. It would be interesting to know what electro-medical school Doctor Bracken belongs to. The record of his practice in the District of Columbia gives ground for the impression that he was accustomed to give allopathic doses to produce homœopathic results, concludes Mr. Maynard.

MR. MARSDEN J. PERRY, OF PROVIDENCE, R. I., FOURTH PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION, 1890-91.

SOME OF THE VISITORS AND THE COMPANIES THEY REPRESENT.

Mr. Samuel Insull, of Chicago, will attend the Convention, going with the special from New York city.

Mr. Samuel Bryan, of the Reception Committee, was a New York visitor last week, and assured his electrical friends of a hearty welcome at the Capital.

The Royal Arc Electric Company will be ably represented at Washington. There will be present Mr. L. E. Howard, Prof. L. B. Marks, A. L. Searles and C. Ransom.

Mr. T. C. Perkins, vice-president of the reorganized Mather Electric Company, will attend the Washington Convention, and a more active and wide-awake gentleman will not be found there.

The President's reception will occur as before stated, on Wednesday at 1.15 P. M. Secretary Thurber writes to Mr. Samuel Bryan that Mrs. Cleveland is not well enough to give a reception.

The long-distance telephone at the Ebbitt House will be free for delegates for personal messages before 9 A. M. and between the hours of 5 and 7 P. M., thanks to Mr. S. M. Bryan and Mr. E. J. Hall.

The many friends of Mr. Frederic W. Royce will regret to hear of his severe illness, and that his physician has ordered him South, thus preventing him from being in Washington during the Convention.

Mr. E. L. Babcock, president of the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio, will arrive in Washington on Tuesday morning, going by way of Boston and New York. Mr. C. A. Brown is now in Washington, and will probably remain until after the Convention.

If you want to know anything about Okonite commune with Capt. Willard L. Candee and Geo. T. Manson, both of whom will be on hand at the Convention in the interest of the Okonite Company, New York. This very popular insulating material will have two popular representatives in Messrs. Candee and Manson.

The General Electric Company will be ably represented at the Convention by Messrs. S. Dana Greene, A. D. Page, J. R. Lovejoy, Wilson S. Howell, F. Todd, A. B. Herrick, R. H. Beach, T. Beran and others. Delegates to the Convention will have the opportunity of examining the new Thomson arc lamp for incandescent circuits, the new recording watt meters for arc and railway circuits, and several other devices combining both economy and novelty.

The Western delegation to the National Electric Light meeting left Chicago via the Big Four, Sunday morning, February 25, and met the St. Louis delegation at Indianapolis, from which point they took a special train over the Chesapeake and Ohio to Washington. The Central Electric Company will be represented by Mr. George A. McKinlock, who will be accompanied by his wife, child and nurse, it being his intention to leave the family at Old Point Comfort for some weeks. The Siemens and Halske Electric Company will be represented by their New York agent, Mr. Charles D. Shain. Mr. S. F. B. Morse will talk Kerite and incidentally have a word to say about the successful young firm, Cushing & Morse. Mr. F. S. Terry will talk Sunbeam lamps to the delegates, and have a sample or two of the new lamp that has attracted so much attention. Mr. M. M. Wood will hold high the banner of the Wallace Electric Company, and keep a bright outlook for any new specialties on the market. Mr. Will. Hine is suffering from a severe cold, which will prevent his joining the party. Mr. James I. Ayer will leave St. Louis Tuesday morning, arriving in Washington Wednesday noon. He expected to have accompanied the western delegation, but found that his duties in connection with the reception to be given by the Mercantile Club, at the formal opening of the new club house on Monday evening, will necessitate a delay of a day or two in his departure.

MR. FRANK H. CLARK, GENERAL SUPERINTENDENT UNITED STATES ELECTRIC LIGHTING COMPANY, WASHINGTON, D. C.

Mr. Frank H. Clark.

Mr. Frank H. Clark, after having spent nearly five years in the service of the Thomson-Houston and General Electric Companies, as manager of their Washington and southern business, resigned to accept his present position as general superintendent of the United States Electric Lighting Company, of Washington, D. C. Before engaging in the electric lighting business he was a paymaster in the United States Navy for more than 20 years. He is possessed of admirable administrative and diplomatic ability, and, as the manager of a public corporation in Washington, must not only see that his stockholders get regular dividends, but prevent Congress from destroying his company by injudicious legislation. He will find abundant opportunity for useful work. On the opposite page will be found a good likeness of Mr. H. C. Burch, the genial proprietor of the Ebbitt House.

MR. CHARLES R. HUNTLEY, OF BUFFALO, N. Y., FIFTH PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION, 1891-2.

Notes of a Trip to the United States and to Chicago—1893.

READ BEFORE THE INSTITUTION OF ELECTRICAL ENGINEERS, LONDON, JANUARY 25, 1894, BY W. H. PREECE, C.B., F.R.S., PAST PRESIDENT.

(*Continued from page 95.*)

Long-Distance Working.

The long-distance speaking in the States is very popular and very successful. The opening of the circuit between New York and Chicago—a distance of nearly 1,000 miles—was so successful that they immediately found it necessary to erect two more circuits. There are now, therefore, three circuits between these two places. I tested these circuits, and found the working remarkably good. It was difficult to say that it was better or worse than the working of our London-Paris line.

The tariff for the long-distance work is based upon one cent per mile for five minutes' talk. The greatest distance that I found upon which speech was conducted was between Milwaukee and Portland, and between these places talking costs 11 dollars (44s.) per five minutes.

Rate of Working.

I found that the customers dealt with by each operator varied very much in different towns. The following table will show this:

Town.	Customers per Operator.	
	Local	Long-Distance Trunk.
Theoretical	100	6
Chicago	66	6
Buffalo	100	—*
Boston	70	3
New York, Eighteenth Street	50	6
Brooklyn	66	10
New York, Cortlandt Street	60	—*

The daily calls per circuit also vary very much. The average per day over the whole country is 8.03. At Chicago on one exchange it reaches to as many as 24.3; the mean for the whole town in January was 13.6, while in July it was 12.3. At Buffalo the mean is 6 It is interesting to note that the number at Buffalo is just the same as it was when I visited that place in 1884. At Boston the average number then was 5; it is now 12.6.

While this average of 12 or 13 calls per day is not an extraordinary one, it represents great extremes in the use of the telephones, which bring about complications which are at times difficult to meet. There are in the main exchange at Chicago, at the present time, several hundred telephones which are used more than 109 times each day. Nearly all this business is handled between the hours of 9 A. M. and 5 P. M. During the busiest hours of the day these instruments are in use almost continually. When calls are made for them, therefore, the only reply is that they are busy. As an example of this excessive use my attention was called to the case of the Waukesha Hygeia Mineral Springs Company, telephone No. 929 South. A complaint was made by one of their branch offices that they could not reach the main office, the line always being reported to be busy. A record was made of the calls handled on this telephone, and in one day it was found to be used a total of 449 times, there having been 18 originating calls and 431 calls received. In one hour the telephone was used 51 times. This is, perhaps, the busiest line of which there is a record. Telephones used by railway offices, wholesale houses of all kinds, hotels, and many other places, are apparently in use almost continuously in the busy hours of the day. Many such establishments have more than one telephone, some of them having as many as six.

* I did not record the number in these two exchanges.

MR. JAMES I. AYER, OF ST. LOUIS, SIXTH PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION, 1892–3.

The subscribers per exchange in the exchanges that I visited are as follows:

Chicago.....10,312, divided thus:

Main	4,912	Oakland	655
South	1,037	Lake View	244
North	996	Wentworth	46
West	906	World's Fair	269
Canal	434	Harrison	424
Yards	492		

New York, Cortlandt Street,....4,500
Boston, Central.....3,545

The total subscribers in New York are 9,574; at Brooklyn, 4,800; and in New Jersey towns within a radius of 33 miles of the New York City Hall, 4,900; making a total of New York and district, of 19,274.

Underground Work.

The statistics that I have given show how rapidly underground cables have come into use in the States. At the Chicago Central Exchange 76 cables, each containing 100 wires, enter the building and ascend up a shoot to the exchange room. The conductor used is smaller than that adopted by us. It is only No. 19 Brown & Sharpe gauge. It gives 47 ohms resistance per mile, and it has a capacity of .08 microfarads per mile. The insulation must be 500 megohms per mile at 60 degrees Fahrenheit. All cables before being used are very carefully tested, not only to see that they comply with the specification as to conductivity, capacity and insulation, but also for what is called "cross talk," by means of buzzers.

There are no less than 30,000 miles of underground wire in New York. 160 cables, each containing 100 wires, enter Cortlandt street building—that is, 16,000 wires enter this exchange. In Boston 91 lead-covered cables enter—that is, 10,920 wires in all, for each cable carries 120 wires.

The cables are made for 50, 60 or 100 pairs of wires. The 50 pair cables have a diameter of one and seven-eighth inches, the 60 and 100 pair cables being two inches and two and one-quarter inches in diameter, respectively. These cables are in all cases brought straight to distributing boards in a room alongside the switchboard room, and here they are brought to terminals in a way similar to that adopted by us, so that changes can rapidly be made.

Subscribers' lines are so distributed among the sections of the switchboards that the work is distributed as uniformly as possible amongst the different operators.

The dry core or paper insulated cable has proved to be a very great success, and is now universally adopted for telephone purposes.

(*To be continued.*)

TELEPHONE NEWS AND COMMENT.

The State legislatures are now reducing telephone rates.

The exchange, at Fort Wayne, suffered much loss by fire Friday of last week.

There seems to be a lull in the organization of new telephone manufacturing companies. What is the matter?

To the promotors of automatic telephone exchanges: Be sure you are right—be sure it will automaticise—then go right ahead.

The Metropolitan company is selling many receivers. These are first-class ones—but don't imagine that exchange service goes with each one you buy.

Canvassing for telephone subscribers goes merrily on all over the country. Cheaper rates and better service are the promises that secure the subscribers. Will these promises be made good?

The Cushman Telephone Company, of Chicago, are endeavoring to start telephone exchanges in Valparaiso, Plymouth and Warsaw, to connect with exchanges at Angola, Rochester, and Ligonier, Indiana.

The Western Union contract with the American Bell expires with 1896. Until that time 20 per cent. of the royalties received by the Bell company go to the treasury of the Western Union. There may be some lively music in 1896—unless a new understanding is reached before that time by these two great rivals in transmitting intelligence—in one case recorded and the other verbal.

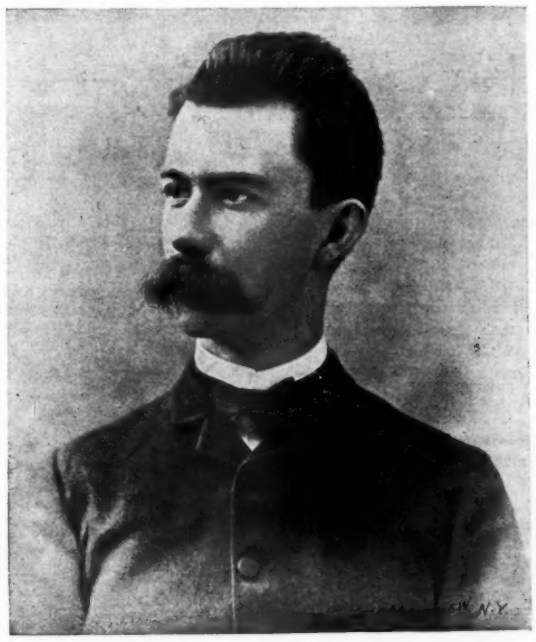
The "Limited Express Service" is to be introduced in the telephone system in San Francisco by the company whose destinies are presided over by Duke Jno. I. Sabin. This "express" idea is that the act of taking down your telephone receiver signals to Central that you are then waiting to tell her that you want to talk to some one. It must be that in the "glorious climate of California" the inhabitants object to exertions of ringing the magneto bell.

The annual meeting of the stockholders of the Southern New England Telephone Company was held recently. The report read by President Morris Tyler contained the following interesting figures: Earnings for the past year, $442,133.53; operating expenses, $309,937.62; excess of earnings, $132,195.71; net earnings, $106,001.06; surplus of 1893, $31,861.46; total, $137,862.52; deducted for dividends, $67,473; balance, $70,389.52. The entire old board of directors were re elected.

A bill has been introduced at Albany, N. Y., fixing telephone rates as follows:

MR. H. C. BURCH, PROPRIETOR EBBITT HOUSE, WASHINGTON, D. C.

Cities of 1,000,000 or over, $78 per annum; 500,000 or more, $66; 100,000 or more, $48; 20,000 or more, $36; 8,000 or more, $30; less than 8,000, $27. At pay stations the charge shall be—not to exceed 10 cents for the first five minutes' conversation, and five cents for every five minutes thereafter. Subscribers are to be furnished with cards, entitling them to free use of pay stations. The State Commission—Comptroller, State Engineer and Attorney-General—may, at any time, if the earnings of a company are proved to be less than 10 per cent. of its paid-in capital, increase the rate.



JUDGE E. A. ARMSTRONG, OF CAMDEN, N. J., SEVENTH AND PRESENT PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION, 1893–4.

Telephone subscribers for a competing company are being secured in the cities in New York in the territory of the Hudson River Company. It is not yet announced when the new service will begin.

The Central avenue street car line runs on Central avenue now. This is not a joke but actual news.—*Minneapolis Times.*

The "Acme" Standard Voltmeters for Direct and Alternating Circuits.

The use of the $C^2 R$ losses in any circuit as a measure of the current flowing in that circuit is a favorite and well-known method of measurement, and has been incorporated by numerous inventors into more or less practical devices of widely different form, for effecting such measurements conveniently and quickly. Such are, for example, the calorimeter, in which the heat generated is made to warm a given mass of water; the Forbes meter, in which the connection air currents from a heated wire cause a set of vanes to revolve, which motion is transmitted to a set of integrating wheels; and the Cardew, Ayrton, and other "hot-wire" voltmeters in which the expansion of the heated conductor records or indicates its amount by means of an index moving over a suitably graduated scale. Of these several devices the calorimeter has been of considerable assistance in laboratory research, but has not as yet been put into any form of really practicable value. The so-called "hot-wire" instruments, however, particularly the well-known Cardew instrument, have been largely used in commercial work, the latter being for a number of years the only direct reading instrument capable of measuring alternating current and electro-motive force.

Instruments of the preceding type, which in general may be thought of as heat galvanometers, possess certain fundamental advantages not attributes of most of the other functions of a flowing current capable of being employed in the operation of measuring instruments. The most important of these is that such an instrument if standardized in any way for direct-current measurements will give exactly the same results when used on an alternating circuit, provided, of course, the circuit be wound non-inductively, since in either case the heating is proportional to the mean square of the current flow without other factors entering. Such an instrument, furthermore, can have no magnetic lag, nor can it be influenced by neighboring magnetic fields or circuits since the magnetic quality of its circuit has no part in the operation of the instrument.

For some years the Cardew voltmeter was recognized as the only standard available for alternating circuits. However, as commercial electricity advanced and study was devoted to instrument construction as well as to heavier problems of engineering, it became evident that the Cardew instrument possessed certain defects hitherto unnoticed, as also that an instrument in which these defects were eliminated was urgently required. Recognizing these facts and being convinced of the intrinsic superiority of the "hot-wire" principle, Messrs. Queen & Co., of Philadelphia, through their electrician, Mr. Willyoung, undertook a thorough study of hot-wire instruments with the object of developing a complete series, both portable and for station purposes, which should be thoroughly adapted to the requirements of the most exacting practice. This work has progressed for some two years, and a number of valuable patents have been taken out, while others are now pending. The line of voltmeters is practically complete and includes portable and laboratory instruments of all ranges from one to 3,000 volts, both single and double scale; switchboard voltmeters for isolated plants and central stations, with or without illuminated dials, and recording voltmeters. All of these instruments are direct reading on either direct or alternating circuits of any frequency, and are dead-beat in action.

The entire line of "hot-wire" instruments has been designated the "Acme" series, a name already associated with Queen & Company's specialties, such as testing sets and microscopes. In the present article we describe only the portable forms, leaving the switchboard types for another issue.

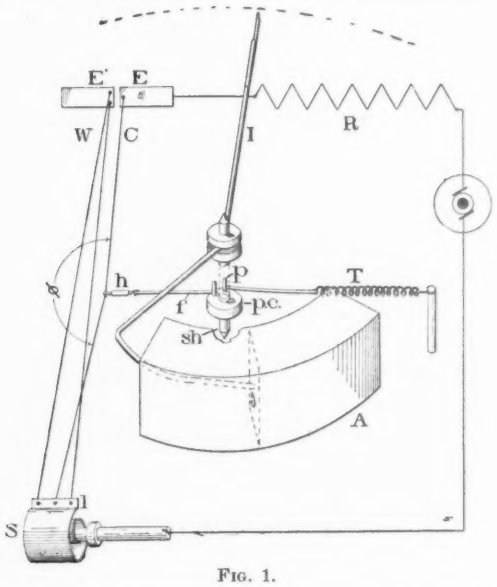


FIG. 1.

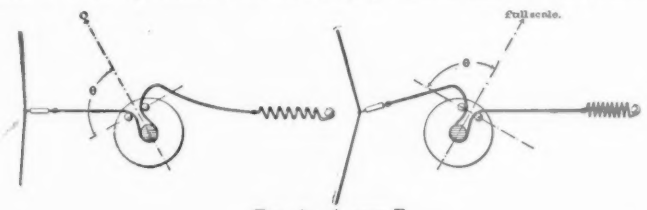


FIG. 2.—A AND B.

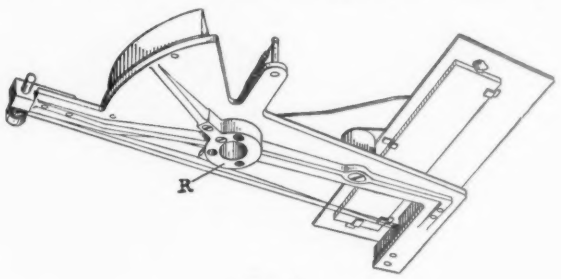


FIG. 4.

Fig. 1 illustrates diagrammatically the essential working parts of the instrument. The "hot" or working wire, C, extends from a fixed support, E, to a spirally wound phosphor bronze spring, S. Midway of its length it is connected to the extremity of a phosphor bronze filament or strip, *f*, which passes around the index shaft, *sh*, engaging as it goes with two small pins, *p*; the other extremity of the filament, *f*, is attached to a spiral "take up" spring, T, whose outer end is fixed. It is obvious that for a very small linear expansion of the working wire, C, there will be caused a many times magnified movement of the middle point in line of the filament, *f*, which movement being taken up by T, results in the carrying of the index I over the scale. The wires W are two or more in number, each of the same or nearly the same cross-section as C, and attached at one end to the fixed plate E, similar to E, but insulated from it, and at the other end to the spring S, to which it is attached. These wires, not carrying any current, serve to restrain S from taking up the expansion of C when current is passing, but being affected by general changes of temperature, such as room temperature, etc., to the same degree as C, let out S just enough for such changes to take up the linear expansion of C, due to the same changes, thus preventing any change of zero of the pointer for varying temperatures. It should also be observed that this compensation is effected instantly, no matter how varied the changes of temperature since the wires, W, are of the same or nearly the same cross section as C. In the Cardew voltmeter the wires W are equivalented by composite rods of iron and copper having the same co-efficient of expansion as the "hot-wire," which gives perfect compensation, but only for low changes of temperature. In all hot-wire instruments, however, the temperature of the working wire rises continuously for some time after the current is thrown on, since the radiated heat will raise the temperature of the chamber containing the working wire until the rate of radiation from such chamber exactly equals the rate of generation of heat within it. Hence the working wires will continue to expand and the reading to increase unless compensation takes place instantly, and one end of the working wire be let out exactly in correspondence with fictitious expansion, as it may be called. In the same way an instrument compensated with rods will read low if a low reading is made to immediately follow a high reading. In the "Acme" instruments absolutely no variation in reading can be detected, whether the current be on for a second, a moment or an hour, and the readings going to any point from zero are exactly the same as when dropping to the same current value from a higher one. The spiral spring S is used in preference to an elongated spring on account of the fact that in an instrument in which the forces involved are so small as in the "Acme" the effect of gravity upon a long spring would be considerable, and would cause the readings to be less or greater according as the spring were lower or higher than the other end of the wires, and small changes of level would, therefore, have to be guarded against. Upon the form of spring used, gravity has no effect, and the readings are therefore not appreciably affected by very considerable differences of level; this freedom from level error is greatly assisted by the fact that the index is very exactly made and balanced so as to have its center of gravity in its axis.

FIG. 5.

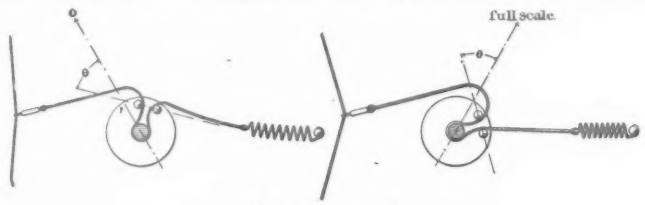


FIG. 3.—A AND B.

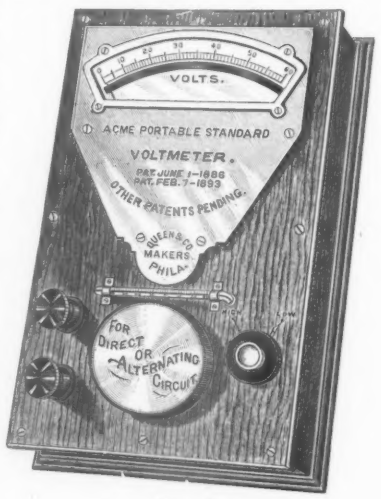


FIG. 6.

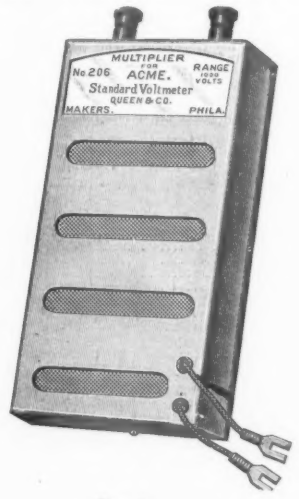


FIG. 7.

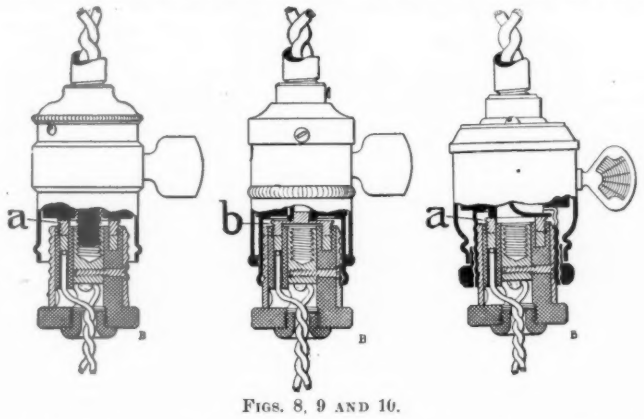
The filament, *f*, is attached to the wire, C, by means of a minute glass connector, *h*, provided at each end with equally minute hooks of platinum wire. The purpose of this glass connector is to interpose between the wire, C, and the filament *f*, an effective insulation, thus avoiding any risk of acci-

dental short circuits in other portions of the instrument. The platinum hook which engages with the wire, C, is fixed in position by a special cement studied out for the purpose, and which but holds more firmly the more it is heated.

A very important function in this instrument is performed by the filament *f*, and the collar *p c*, with its pins *p*. All hot-wire instruments, as was promised, give indications practically proportioned to the square of the current, since the total heat developed in any circuit is C^2 R and R, in the alloys, varies so little as to be negligible in comparison with C. The scales of such instruments, therefore, are exceedingly crowded at first, and open up more and more toward the upper end of the scale, varying in size proportionally to C^2, the square of the currents which they represent. Such a scale is also obtained on an electro-dynamometer by graduating the positions of the torsion head which keeps the coils at right angles to one another. Scales of this character are eminently undesirable except for certain special purposes, what is wanted being a fairly uniform scale throughout the whole range of the instrument, so that readings at a low point of the scale can be made with not greatly larger errors of reading than at high.

The particular arrangement of filament and collar just referred to was devised to secure this very result, and it performs its duty admirably. The manner of its operation may best be seen by inspection of Fig. 2 (*a* and *b*) and Fig. 3 (*a* and *b*), which represent enlarged diagrammatic views of the arrangement at zero and full scale deflection for two different positions of the collar *p*, *c*, with reference to the pinion *sh*. The filament, *f*, is of tempered phosphor bronze rolled flat from a wire 0.0015 inch in diameter. After rolling it is subjected to a careful course of treatment in order to age it and provide against changes of elasticity taking place with time.

A defect common to "hot-wire" instruments has been the difficulty of preventing the instrument from changing its reading or its zero when the containing case becomes strained mechanically in any way. This is particularly noticeable where small movements are magnified, and increases in the ratio of magnification employed. To avoid any such trouble the entire operative structure of the "Acme" instrument is supported upon a ribbed and very strong aluminum casting, which is itself attached to the containing case at but one point, shown clearly in Fig. 4. In this way the case of the instrument may be warped or twisted to any extent, even to actually breaking the pieces, without in the least degree disturbing the indications of the instrument.



FIGS. 8, 9 AND 10.

Fig. 5 shows one of the perfected forms of this voltmeter, being the style intended for inspectors, engineers and others having accurate testing to do in various places. In order to use as fine a wire for this extra resistance as possible, and thus diminish bulk and weight, the extra resistance coil is clamped between two aluminum plates, made part of the lid of the instrument, as shown in the figure, a pair of small flexible leads connecting it with the working wire.

Another form of this instrument, shown in Fig. 6, has been designed for laboratory use, and for those engineers who prefer an instrument without hinged lid. In this form the extra resistance is contained in a metal box located between the binding posts and contact key.

Fig. 6 shows the manner in which the switch for a double scale instrument is actually applied. It consists of a milled rubber head surrounding the contact key, thus being extremely convenient for use. The switch proper is attached to this head beneath the cover of the instrument, and makes its proper connections when the switch is rotated through a small angle. A small index point fixed to the milled head points to the word "high" or "low," according as the high reading or low reading scale is to be used.

An exactly similar device is applied to the form shown in Fig. 5 when it is desired to make a double scale instrument.

Instruments of the form illustrated in Figs. 5 and 6 are not adapted for higher electro-motive forces than 600 volts, owing to the impossibility of securing in such small compass sufficient insulation and heat-radiating surface for greater potentials. Accordingly a separate series of boxes has been designed to contain the extra resistance when high range instruments are desired, and the scale of the instrument is made to indicate the electro-motive force actually at its own terminals. When the separate extra resistance is put in series with the instrument, then scale readings must be multiplied by some factor, depending, of course, upon the amount of multiplying resistance used. One of these multipliers is shown in Fig. 7. The partition walls are made of fibre, and each little box holds a non-inductively wound coil. These coils are adjusted so that more than 75 volts is never contained in a single box; hence there is no risk of burn-out or accidental short circuit, even when working with potentials of several thousand volts.

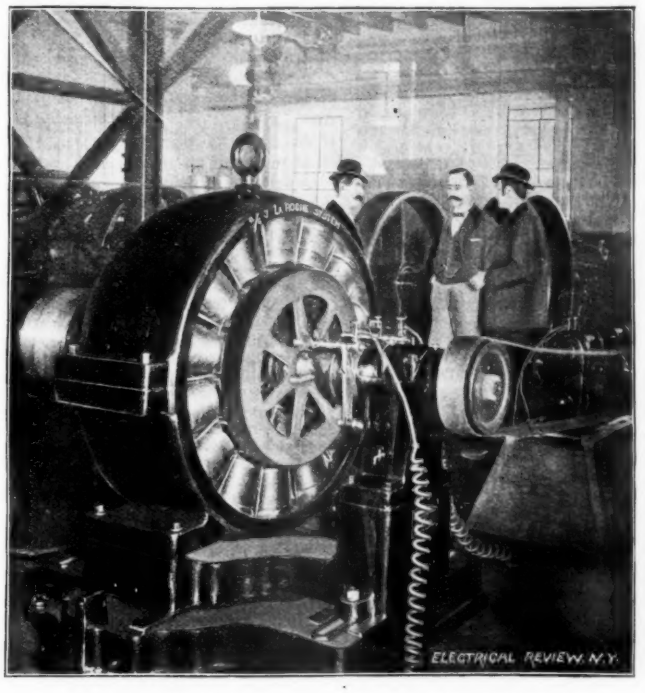


FIG. 1.—LA ROCHE ALTERNATOR AT QUINCY, MASS.—(See page xiv.)

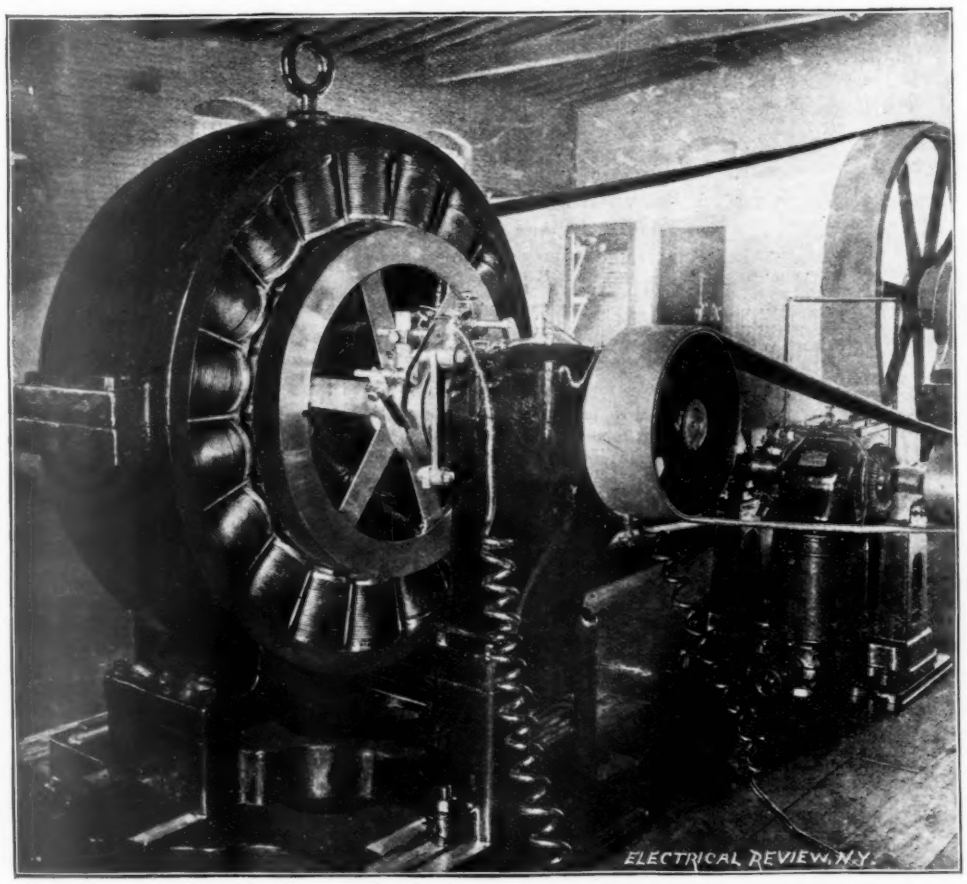


FIG. 2.—LARGE LA ROCHE ALTERNATOR AT QUINCY, MASS.—(See page xiv.)

One of the principal uses of an instrument like the "Acme" voltmeter is in measurements upon various incandescent systems as, for instance, measuring the potential at various points on such a circuit so as to determine the drop in the line, and in general measurements upon such systems to ascertain whether specifications or proper conditions of running are being complied with. In order, therefore, to make such measurements quickly some convenient means must be at hand for connecting the voltmeter to the mains. One of the best of these is to have a "plug" similar to the end of the particular type of incandescent lamp used in the circuit being operated upon and provided with flexible connecting wires going to the voltmeter.

To make a measurement at any point it requires simply to remove the lamp and insert the plug in its place. This method has heretofore required a different plug for each system, and an inspector has consequently been obliged to carry about with him as many plugs as there were systems to operate upon. To avoid this the special plug or "adapter," as it is usually called, shown in vertical sections in Figs. 8, 9 and 10 has been devised. This adapter is so constructed that it is equally applicable to the Edison, Thomson-Houston or Westinghouse sockets, these being the principal forms in general use.

As to accuracy, it is claimed by the makers that results can be obtained with this instrument well within one-quarter of one per cent. on either direct or alternating currents of any frequency, and this on alternating circuits much more quickly than with any other instrument known. No difference can be detected reading up or down the scale, nor in the voltmeter affected by magnetic fields or heavy currents in its vicinity.

These instruments are manufactured under the fundamental Cardew patent, which relates to applications of the "hot wire" to electrical measuring apparatus.

A sample exhibited at the World's Columbian Exposition received the highest award: "For the success attained in *overcoming* the defects of the ordinary hot-wire instrument, viz., lack of great range in which the instrument is sensitive, great correction due to change of temperature and inconstancy of position of zero point, and also for its compactness, portability and excellence of mechanical construction."

"Up to Date."

[*From the Newsdealers' Bulletin.*]

The ELECTRICAL REVIEW contains an account of new inventions in electrical art and science, new enterprises, and does all the various other work of a journal in the line indicated by its title. It is genial and moderate in tone, handsomely printed and "up to date."

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HO, FOR WASHINGTON!

The triumvirate on the first page of this issue are not exactly three of a kind, but each individual was an important factor in the early success of the National Electric Light Association.

The parlor occupied as headquarters by the ELECTRICAL REVIEW, at the Ebbitt House, Washington, is in a convenient location and every visitor will be welcome. The services of our staff are at the disposal of our friends.

We have presented both sides of a recent storage battery patent suit. As the case will be decided next April, we trust our lively storage battery correspondents will now be satisfied to wait for the court's decision. We are glad to see active, wide-awake men still in this field.

THE N. E. L. A.

The National Electric Light Association is nine years old. It has a most honorable and attractive record. It has always kept step with progress.

It is the future that the student of events finds problematical. Shall this Association, now that electric lighting has become, we may say, standardized, drop into a mere roll-calling, routine-producing body, and perhaps disappear altogether, like the Telephone Association and other organizations, or will it broaden its field, comprehend all progressive electrical branches of industry and compass within its membership all properly interested persons? The well-wishers of this Association should look carefully to its future, and if union with that other progressive electrical body, the American Street Railway Association, could be effected, we believe the result would be beneficial to both.

At least we think the idea worth consideration.

The president of the N. E. L. A. to be elected at Washington this week will have responsibilities of no light weight. May he be the right man!

THE ELECTRIC LIGHT.

The march of improvement during this great nineteenth century has been most remarkable. Many inventions have appeared, and of far-reaching importance, affecting favorably the convenience, comfort and enlightenment of millions of people.

But we believe that among them all the introduction and general adoption of electric lighting will be found as conspicuous an example as any of the others, if, indeed, it does not occupy the foremost position.

The locomotive, the cotton gin, the harvester, the compressed-air drill, the telegraph, the telephone and a thousand other inventions have all exerted a tremendous swaying influence on the prosperity and happiness of the civilized world, but none of these has directly reached into the daily lives and brightened up the dark nights for the community so extensively and beneficially as the electric light. A few years ago it was, if not unknown, kept within the narrow boundaries of laboratories and lecture rooms, and even there it was the crudest type of an electric arc maintained spasmodically by labored attention to a battery. It was only a beautiful experiment foreshadowing the great things to come. And long within the space of a single generation it became a grand achievement, cities adopted it in all parts of the globe, and to-day every town of a few hundred inhabitants looks upon an electric lighting plant as a public necessity.

It was not long till the statement became a demonstrated fact that an arc light in the streets was as good as a policeman. Cities rapidly realized the value of electric lighting of their thoroughfares as a measure protective of the life and property of their citizens. Slugging and sandbagging became unfashionable, people began to stream abroad at night to an extent before unknown, theatres and other amusements prospered in an unheard of degree, and municipal electric lighting became one of the great monuments of the genius of the century.

Commercial arc lighting rapidly took a position no less conspicuous and successful. Storerooms, lecture halls, restaurants, railway stations and the thousand other places of public resort had their gloom and cheerlessness annihilated, and night became day.

Then at last came the great achievement, the greatest blessing of electricity—the incandescent lamp. What a boon to humanity it has proved! Scattered over the world, numbered by the million, adorning the homes of the rich in a fashion undreamed of a few years ago, lending its soft radiance to the less pretentious dwellings of mankind generally, the glow lamp has reached a pinnacle of popularity not often attained by any invention of man. It is a fair subject for the rhetorical rhapsody of a panegyrist.

All this era of extensive lighting has had numberless beneficial results apart from the direct benefits of the light. The work led to the evolution of the dynamo in all sizes and of several generic types suited to the work; the study of these led at once to the evolution of the electric motor in all its beauty and adaptability. Improvements and applications thronged the path of progress, and almost before the path could be seen the electric railway was in existence, the cars, electrically lighted, were whirling happy mankind from place to place, and another bright star had been added to the galaxy which now sheds an everlasting glory on the deeds of our army of electrical workers.

But with all this array of great achievements, victories torn from the very depths of nature, there is much to be done yet, and the pioneer fraternity, the Electric Light Association, we trust, is girding up its loins for further campaigning, and should be stronger, better equipped and better generaled than ever.

The arc lamp is yet to be touched up to more perfectly uniform action, the glow lamp is to be cheapened, alternating current motors are to be perfected, electro-metallurgy is to be fostered and brought more generally into commercial usefulness, conduit railways must be attained, storage batteries or gas batteries of a permanent type are to be designed, long-distance transmission must come, and a host of other kindred tasks remain. We are but on the threshold of the electrical age.

ELECTRICAL ODORS.

An enterprising perfumer of Paris has lately, it is stated, been the center of interest among his associates and those with whom he deals. His sales of the several odors manufactured by him have somewhat increased, the quality of his perfume has become better, and the subtle odor of his wares is fast bringing him to the front rank in his line. The strange part of his business is that he is now buying no essential oils in the quantities he had before been accustomed to.

This, of course, attracted the attention of his confreres, and he kept their expectation on the *qui vive* by purchasing an electric light plant for his laboratory. An individual who, it is claimed, is competent to judge, declares that the process now used by the manufacturer is, in part, an electrical one; and he further states that merely one or two essential oils are used, the changes in odors being effected by the ozonizing influence of the current. If this be true a vast field is opened to the perfumer, who now needs but lay in a stock of alcohol and a little bergamot to turn out perfumes as delicate as the rose and as evanescent as the lily of the valley. He needs but be supplied with an ozone regulator and an attractive assortment of labels to make him the equal of a Guerlain or a Lubin. The aging of whiskey by electricity is gradually becoming a practical process, and distillers are beginning *not* to recommend it. They prefer to keep a room locked where they allow Father Time to exert his good influence, while they wisely shake their heads and advise against the use of electricity.

No doubt we shall shortly have electrically flavored ice creams, and our syrups will be rated according to their differently prepared voltages. What next!

The poet of the ELECTRICAL REVIEW is laid up for a few days, due to overwork. Cause on page 104.

CORRESPONDENCE.

OUR WESTERN LETTER.

The Chicago Telephone Company's employés have given $199 to the Central Relief Committee, to aid the unemployed.

Mr. Calvin Austin, secretary of the Effingham Electric Light and Power Company, of Effingham, Ill., was purchasing electric material in Chicago this week.

Mr. Charles Blizard, the Chicago representative of the Chloride accumulator, is meeting with good success in interesting purchasers in the merits of his excellent cell.

Goudie & Hoffman have just completed the plans for a $100,000 apartment house for John T. Schwarz. An incandescent plant, electric elevators and other improvements are included.

Mr. Quincy's Company.—Mr. William E. Curtis, the Washington correspondent of the Chicago *Record*, devotes three columns in the issue of the 19th to an *expose* of the methods by which the illustrating of the *Patent Office Gazette* passed into the hands of the present company.

Mr. E. F. Seixas, formerly with the Edison interests, and later with the *Street Railway Gazette*, has entered the offices of Mr. J. L. Barclay, at 1645–8 Monadnock Building, Chicago, and will aid in exploiting the street railway apparatus manufactured by the Walker Manufacturing Company.

The Sioux City Engine Works has been secured by a local syndicate composed of seven of the wealthiest men in the city, who bid it in over the Credits company, assuming the $150,000 liabilities and paying $20,000 for the equity. They consolidated with the Peck Manufacturing Company and incorporated the Sioux City Engine and Iron Works with a capital paid up of $240,000.

The Darrach Fender.—Superintendent M. K. Bowen, of the South Side lines, in referring to a test made with this fender, says: "I hope it is all that is claimed for it, for it would mean a great deal, both from a humanitarian point of view and for the interests of street car companies. Such devices are invented almost every day, and while all the models seem to work satisfactorily enough, when the working device is put into operation it invariably is found to be impracticable."

The New Tunnel.—The third tunnel passing under the Chicago river is completed and will soon be in the service of the Van Buren cable line. From Franklin to Clinton street the tunnel is 1,514 feet in length. For about 600 feet at each approach the dip is one foot in every 12 feet, and thence one to 18, while near the center it is but one in 55 feet. It is a single arch tunnel, having a clear width of thirty feet and a clear height above the track of fifteen feet nine inches, and this is said to be the largest bore of any tunnel in the world, save one in England. It is of sufficient width to permit two cars to pass with a space of four feet between the cars and between each car and the adjoining wall. This tunnel is lighted throughout with the Standard Electric Company's arc lamps.

Fire Hazard—At the semi-annual meeting of the Illinois State Board of Underwriters a report was presented by George W. Hayes, Jr., of the Lancashire Insurance Company, on the subject of electricity as a fire hazard. On the question of charges for deficiencies in installation Mr. Hayes states: "The only way the underwriter can receive help in meeting an increased loss ratio from an ascertained cause is by making an extra charge therefor. It is universally conceded that thousands of buildings already wired by inexperienced and incompetent workmen will cost the companies millions of dollars in losses by fire. Let us at once set about receiving payment for the increased loss ratio on the imperfectly completed work, and by raising rates on faulty construction of future equipments demonstrate to the electric companies that they must correct faults or they will have no patronage because of too high cost to the consumer. In this way we strike at the root of the evil, help ourselves, and fulfill that important public service of fire underwriters, make safer the homes and business interests of our customers from loss by fire." F. De L.

Chicago, February 23.

President Bracken Replies to President Gibbs.

To the Editor of Electrical Review:

I notice in your issue of the 21st inst. a communication from Mr. Gibbs, president of the Electric Storage Battery Company, in which, after serving up the old story of Profs. Chandler and Barker, as to the Chloride accumulator not being an infringement of the Brush patents, he goes out of his way, in tradesman-like style, to decry the wares of his rival. He tries to make us believe that this attack is invoked because my company has seen fit to exercise its legal right to sue him for infringement of our patents. This is the only offense of which we are guilty. We disclaim Mr. Gibbs' charge of the circulation of any objectionable matter in relation to his battery, except that in one or two instances we have sent to purchasers the usual notice of infringement, which, in a measure, we are bound to do, under the rulings of the courts, if we expect to invoke the aid of the law in securing damages hereafter.

I think, Mr. Editor, that the over-confidence which Mr. Gibbs assumes is calculated to give all the less weight to his statements. You will perceive that this is the more so when I tell you that the company owning the Chloride battery in France, the Societe Anomyme pour le travail Electrique des Metaux, was sued last year by the company owning the French Faure patent, and that Baron Rothschild, who is largely interested in the Chloride Battery Company, purchased peace at the expense, as I am informed, of several hundred thousand dollars. The French Faure patent is the equivalent of the American patent 252,002, and has only one year from next October to run. It was decided by our courts here that the Faure patent and the Brush patent were for the same invention. The same decision was rendered by the Patent Office, in the interference between Brush and Faure. The Faure patent was also sustained by the highest courts in Germany, in a decision much more far-reaching than any of the American decisions sustaining the Brush or Faure patents here.

In the light of these facts, it can hardly be contended that Mr. Gibbs is candid in proclaiming to the public that he does "not infringe the Brush or any other patents in the slightest degree." Professors Chandler and Barker, under whose banner he hopes to win the coming battle, were also expert witnesses in the attempt to break down the Brush and Faure inventions in former suits, and they swore with as much zeal and vehemence in those former suits that the Brush-Faure patents were invalid, etc. It is fair to presume, in the light of history, that their affidavit, which Mr. Gibbs publishes, would hardly justify a man in purchasing the Chloride battery, or the public in believing them. The fact is, we must assume that Mr. Gibbs is desperate, for he writes like a desperate man.

Yours truly,
Wm. Bracken,
President Consolidated Electric Storage Company.
New York, February 21, 1894.

Mr. Lockwood Corrects Mr. Preece.

To the Editor of Electrical Review:

I observe that you are publishing in full the admirable address of Mr. W. H. Preece, recently delivered to the Institution of Electrical Engineers, London.

In it the statement is made that "the capital of the Western Union Telegraph Company was in 1877, $22,000,000."

This is not quite correct; the fact is that in 1877 the capital stock of the Western Union Telegraph Company was $41,073,410, as stated in the *Journal of the Telegraph*, October 16, 1877, p. 305.

In the annual report of the Western Union company for the year ending June 30, 1876, which report is printed in the *Journal of the Telegraph* of October 16, 1876, it is stated that the capital stock of the company is $41,073,410, of which the company owns and has in its treasury $7,272,235, the difference, $33,801,175, is the amount outstanding.

Of course, a slight misstatement of this kind is easily made, and it would not be worth correcting except for the fact that the sum named by Mr. Preece is made the basis of comparisons.

Very truly yours,
Thomas D. Lockwood.
Boston, Feb. 21, 1894.

Electrical Measurements.

A LECTURE DELIVERED AT COOPER UNION, FEBRUARY 5, 1894.

BY A. E. KENNELLY.

(*Continued from page 93.*)

There is the cross-section of a box. You see that this box is of wood, with a hard rubber top, surmounted in its turn by a brass layer. Above the brass layer there project certain brass plugs, with brass handles. Here is the wooden box; here is the hard rubber top, and here are the brass pieces. They are separate from each other, and they have no superficial electrical communication, unless it be by the plug. If you drive a tapered plug into the tapered recess between them with about two pounds pressure, you will produce literally, say, about 25 pounds of pressure, literally wedging the plug fast between these two surfaces, and that will be sufficient to make a good contact between them, so that the current will find no resistance in passing from one bar to the next. If the plug is dirty there may be considerable resistance, but if the plug is clean and driven well home, there will be practically no barrier to the electrical current between this bar and the next. When you remove that plug you do not disconnect or break the circuit altogether, because there are connections here beneath by which the current will pass through wire wound on bobbins below, so that the current does not stop altogether, but can continue through these coils of resistance, and by making the length and the size of the wire of the proper amount you can cause any one of those little holes to correspond to a certain amount of resistance. For example, the first one here is one ohm, and that corresponds to the same amount of resistance that you have here in our standard coil we have already considered. The next one is two ohms, and so on going up through successive units, tens and hundreds, into thousands. Each plug controls a certain amount of wire and you know when you join up the box, between those two ends in the circuit, you can make the resistance in here, either nothing, by putting all the plugs in, or you can successively introduce more resistance to any desired amount within the total range by pulling the plugs out. In the Wheatstone bridge you have an apparatus of just that kind. The sole purpose of this box in manipulation is that you can pull out the plugs and so adjust its included resistance. That is the construction of practically all the resistance boxes that are made and they are always calibrated in ohms. They commence, usually, at one ohm and they do not, as a rule, go above 10,000. But, of course, you can get much higher resistances. The higher the resistance the longer and the thinner the wire has to be. You can look upon a pipe as being the analogue of a wire carrying an electric current, because the longer the pipe, the more resistance, and the narrower the pipe, the more resistance. These bobbins in the box are so adjusted that as you get into big resistance you get into finer wires and they are wound into a greater number of turns. You have now at your disposal the plan by which electrical resistances are usually measured. You have a circuit whose resistance you desire to measure. You join it up with a Wheatstone bridge in such a way that you find that no current will flow through the galvanometer, and when you have succeeded in that, the number of plugs pulled out represents the number of ohms in the circuit.

The next process that we will give you the complete control of is the manner in which electrical pressure is measured. Suppose that you had some pressure to measure. You did not know what it was. It might be a cell of batteries and you had to find out how many volts were developed in a certain cell of battery. You might go about it in this fashion. You would take a number of standard cells such as this, each a volt, and you would join them all up in series. You would then take the battery you wanted to measure, and you would join up your galvanometer here with one end of this battery, and then you would seek for some place where you could connect that wire on and find no current, because, supposing that this cell had exactly the same pressure as that first volt represented, if you joined that wire on at the first volt, there would be a pressure of one volt acting this way and a pressure of one volt acting the other way, and the galvanometer would show nothing. But if this cell you were measuring had two volts you would have to go another step and bring into circuit two of these standards, and these two would make a pressure sufficient to keep the current back. When you succeeded in doing that you would know that the electric pressure of the cell would be just equal to the number of cells here—the number of volts there that you had in your standard battery. But that would not always be sufficient, for the obvious reason that you are not always measuring exact volts. You could not measure two and one-half. Your galvanometer would show a current in one direction at two, and when you made the next step to three the galvanometer would move the other way, so you would have a sub-divided pressure, and you cannot sub-divide this volt. But there is an equivalent device to that which immediately follows, on this principle. Here is a diagram that represents the way pressure falls along a uniform conductor. At this end you have a pressure of, say, 20 volts, and at that end, the final extremity of the wire, it falls to zero. You have, therefore, a simple straight line representing the fall of pressure. Half-way along the wire you would not get more than 10 volts pressure; just in the same way as half-way along a uniform river, at which the fountain head had 10 feet of elevation, you would find five feet elevation. You could, therefore, substitute for this row of cells a wire carrying a current and maintaining a pressure in that way, and instead of going by jumps from one volt to two volts you can run along that wire as smoothly and as slowly as you please and get any degree of fineness in the calibration. You can find any point you like at which you can obtain a balance between the pressure you are testing and the pressure you have in this wire. The moment you have a balance through your galvanometer, you would observe by this simple means how far you were along that wire, how far the pressure had fallen, and how much the pressure would be in the battery you are testing. That is the most usual and the most accurate means known at the present time of measuring pressures. Of course, it has to be modified occasionally. It is awkward if you are measuring 5,000 volts to build up a comparison pressure here of 5,000 volts. The difficulty is obviated, however, as a mere matter of detail, by taking a certain small known fraction of the 5,000 volts you are measuring and comparing it in this way with standard cells, so that this standard cell of one volt would be capable of being compared accurately with 5,000 by taking one-thousandth part of the 5,000 volts. It is a simple matter to do that by allowing the current to pass along the wire and taking a fraction of the wire for the representation of the proportionate degree of pressure. That gives you, therefore, the means which exist at the present time of measuring electrical pressures. The apparatus follows immediately on this diagram. Here you have a long wire and here you have any kind of pressure in battery which will send a steady current. It does not matter what the voltage is. You do not want to know what this pressure is All you want to know is that it will be steady, and you have a resistance here, so much more wire, that you can adjust by pulling out plugs, or by lengthening a wire, anyway you please, so that you can make the current in this wire greater or less at will; and here you have a galvanometer and your standard volt, and here you have a pointer acting through a switch. That is to say, a strip of metal that you can turn over either on this point or that. If the pressure here in this length of wire is just equal to one volt, the galvanometer will stand at rest. What you do is, you mark this wire off into a thousand parts and you so alter this controlling resistance that when the pointer is standing at 1,000 the galvanometer shall show no current. That, of course, is a mere matter of convenience in detail. You get this pressure equal at both sides on that point for your standard measurement, and then you take this pressure that you want to measure and you throw the switch over to the opposite side, and then you displace the pointer until you again find a spot at which there shall be no current through the galvanometer. When you have found it you know that just the distance you travel here represents volts, and so that long wire is the means of carrying out that measurement. That is called the potentiometer method of measurement.

Now, there is another way, less fundamental, but more general in application, for measuring electrical pressures in volts, and that is to take a delicate galvanometer and insert a comparatively large resistance in circuit with it, say 10,000 ohms in all. The amount of current which will pass through and be registered by the galvanometer will depend directly upon the pressure brought to bear upon the terminal of the circuit by Ohm's law, and the indications of the instrument can, therefore, be marked off by trial as corresponding to pressure in volts at those terminals.

(*To be continued.*)

PERSONAL.

On February 19 Mr. Paul Wilcox and other local capitalists applied to the Township Committee of Montclair, N. J., for an electric lighting franchise. From 500 to 800 incandescent lamps would be required to light the whole town. The application was referred to the Street Lighting Committee, M. N. Baker, chairman.

A RETROSPECT.

ORIGIN, ABIDING PLACES AND SUCCESSIVE ADMINISTRATIONS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Sung by an Electric Bard in Quaint and Happy Phrase, with Lapses into Poetry About Scenes of Other Days —From Chicago to the Capital and Other Towns En Route, this Great Electric Body Described in Terms to Suit.

HOW IT CAME ABOUT.

A convention of delegates, representing companies doing an electric lighting business in the United States and Canada, will be held at the Grand Pacific Hotel, Chicago, on Wednesday, February 25, 1885. Every electric lighting company in the United States and Canada is invited to send delegates properly accredited. Delegates will find headquarters established at the Grand Pacific on their arrival.—Editorial in ELECTRICAL REVIEW, *January 17, 1885.*

THE ASSOCIATION'S BIRTH IN CHICAGO, 1885.

This sound to arms above will show
The way the thing was done ;
Chicago had the honor first,
Though "specials" were not run.
Cy Baker was not then on guard
As he is now to-day ;
The railroads owned the universe—
Now Baker has *his* way.

A man named Billy Hovey
Called the meeting of the few ;
He was a nob'le editor
Of the ELECTRICAL REVIEW.
He talked a lot of everything,
And gave the ball a push
That set it turning round and round,
'Till it's rolling with a rush.

He named for chairman, Bowen,
Who at once began to send
His voice out in a question,
Anent the dividend.
From Baltimore a man dared come,
By parent company told
That if he went away from home
He'd be out in the cold.

This pleased the sturdy delegates,
Who gave their joy full vent,
By making J. Frank Morrison
Their honored President.
Time proved the wisdom of this choice:
Right here 'tis well to note,
He served three terms successfully
With no opposing vote.

Chicago's Mayor, in facile phrase
(We think 'twas from the Greek),
Described the incandescent glow
As "down on maiden's cheek."
The giant oak had felt its power,
The rock 'twould melt, said he,
This subtle fluid was, in fact,
"The breath of Deity."

Discussion followed thick and fast
On topics funny now ;
The cost of light was figured on,
Until a man told how,
With power from a waterfall
And sample carbons free,
He got his light for nothing—
Object of envy, he !

FATHER KNICKERBOCKER GREETS THE APOSTLES OF ELECTRIC LIGHT, 1885.

On the isle of old Manhattan,
By the shining Big-Sea-Water,
Next we find this worthy body,
Six months old and yet a goodly
Band of braves and sturdy stalwarts.
When the routine of the meeting
Was disposed of, gently, quickly,
What should make an active member
Was discussed with vim and vigor.
Pushing Porter, carbon maker,
Owner of a one-light glimmer
In a factory, claimed a vote
As active member firmly, strongly.
From this pow-wow came the edict,
Central station lighters only
Active, voting members could be.
Then with fulsome chin-chin music
Topics such as these were talked of:
Insulation, tower lighting.
Briefly touching buried wires,
Cost by steam or water-power,
Dynamos, electric motors,
The relations then existing
As between a child and parent.
Doctor Moses, silver-tongued one,
Incandescent lighting favored.
Then with knowledge greatly increased
This brave band meandered homeward,
In the glory of the sunset,
In the purple mists of evening—
Some preferring mists of morning.

THE LAND OF TERRAPIN AND CANVAS-BACKS, 1886.

To Baltimore then did repair
This body great, still paying fare;
The mayor welcomed to the town,
And they to business settled down.

To mutually insure their plants,
'Twas thought would be a great advance;
The cost of coal, the gauge of wire,
The engineer, his rate of hire,

Arc carbons soft, arc carbons hard,
With batteries, were on the card,
And were discussed both pro and con
By Lynch, Weeks, Smith and Morrison.

Greek "*dyn*-amo" was then espoused
By Moses. Cooper was aroused—
"No Greek for me ! Plain Saxon goes :"
And the meeting voted "*dy* namos."

The constitution was, of course,
Changed just a bit, with no remorse ;
Doc. Duncan then gave out with zest,
In language choice, his glow lamp test.

And Rowland told the luck he missed
When he was not by fortune kissed ;
For in the "sixties" he let go
A chance to patent his dynamo.

"Long contracts are the thing," said Maher,
"In favor of them I declare ;"
The method right for carbon test
Was told by Ridlon to the rest.

The points discussed were not a few.
Though there was much they still could do,
The meeting quietly adjourned,
All feeling they had something learned.

DETROIT, 1886, PHILADELPHIA AND BOSTON, 1887, PITTSBURGH AND NEW YORK, 1888.

Here's five Conventions in prose: Vice-President Weeks presided at Detroit in the absence of the president. Electrical subways were protested against, Patent Office improvements were suggested, high tension and low tension currents were exhaustively discussed, and the usual amendments to the constitution were rejected. With a notable increase in membership, the Convention at Philadelphia discussed Garratt's wire gauge report, insulation and installation. Lieut. Sprague presented a modern electric motor, and the distribution of electrical energy by "secondary generators" was a prominent topic. The Convention was stampeded in the midst of an important discussion by the excited announcement of a hungry member that the hotel dining room "would close in five minutes." At Boston, during the usual amending of the constitution, associate membership was abolished, all associate members becoming actives. Slattery's address on alternating currents received great attention at this meeting. A magnificent banquet was spread for the delegates at Point of Pines by the Thomson-Houston company. The next day the delegates partook of Eugene Phillips' incomparable clam-bake at Providence. The Pittsburgh meeting was memorable for a novel proceeding—the constitution was amended : Aside from this, the Convention was of a most practical and important nature. Instructive addresses on belting by C. A. Schieren, on steam pressure records by Jarvis B. Edson, on engines by Wm. Lee Church, on alternating currents by O. B. Shallenberger, on underground wires by W. W. Leggett, on general electrical work in England as compared with the United States by Prof. George Forbes, and other papers of a similar character were delivered and discussed. S. A. Duncan, of Pittsburgh, was elected president in place of J. Frank Morrison, who declined to serve a fourth term. The New York Convention was welcomed by Mayor Hewitt, who made the delegates feel proud by calling them "benefactors—apostles of a new industrial dispensation." An up-to-date programme was disposed of with profit to all, overhead and underground wires in New York city being exhaustively treated, Dr. S. S. Wheeler presenting a paper on this subject. By way of variety a new constitution was adopted instead of amending the old one. At an afternoon session, held at the rooms of the New York Electric Club, Ex-President Morrison was presented with a handsome and costly gavel and stand, and Mr. Geo. Westinghouse, Jr., at the same time received from the Association a morocco-bound copy of its proceedings, in recognition of favors he had extended at the Pittsburgh meeting. The delegates, on one evening, on the invitation of the ELECTRICAL REVIEW, attended the great open air play, the "Fall of Rome," and on another evening the Okonite Company invited all the visitors to a theatre party.

WESTWARD HO, AGAIN. CHICAGO, 1889.

Out of childhood into manhood
Now had grown the N. E. L. A.,
Skilled in all the craft of lighting,
Learned in all the lore of railroads.
With a "special," lightning lighted,
On the Pennsylvania Railroad
With their children, wives and sweethearts,
Out from New York to the westward,
Toward the sunset went the brave ones
To their first love.
They were welcomed by John Barrett,
And to business they proceeded.
Highly honored was Chief Duncan,
For the Central 'Lectric Comp'ny
To him gave a cable gavel.
"Conduit," "conduit," "conduit," "conduit,"
Was the topic, topic, topic;
Subway Johnstone, famous whiskers,
Led the fight for undergrounding.
Central stations favored air wires,
And prevailed by resolution,
Though the contest was a fine one.
E. R. Weeks, of Kansas City,
Then the chief for next year made was.
One great feature of this meeting
Was the 'lectric exhibition,
Up to then the best on record.
And departed from Chicago,
To their homes the brave and bright ones,
Next to meet at the great waters,
Falling waters of Niagara.

NIAGARA FALLS, 1889.

The first point at this meeting brought up for debate,
Was where the World's Fair *we* should fitly locate.
New York and Chicago locked horns in a fight—
Drawn battle resulted without settling the site.

Then a loud cry for peace between central stations
And insurance men bold, who try to set fashions
In premiums and rates on our engines and boilers,
Went up from the crowd of electrical toilers.

The killing of criminals by electrocution,
Was fought as opposed to the State constitution.
The new legislature 'twas resolved to request
To expunge from the statutes a law so unblessed.

Electric street railways, a model light station,
Storage batteries for traction and all information
Pertaining to these, and more topics as well,
Were discussed at great length, too long here to tell.

Then came the great row as to membership classes.
The committee's report favored dividing the masses
Into actives, associates and members of honor,
The convention "accepting" the change thrust upon her.

Chairman Weeks then declared that the form of "acceptance"
Was the same as "adoption"—thus missing their chance,
The new made "associates" were wild with confusion,
At losing their votes by apparent collusion.

The question of where to hold the next meeting
Created great turmoil, although time was fleeting.
Weeks gave up the chair to Frank Morrison brave,
Who used as a gavel a thick barrel stave.

All appeals from the chair were refused without pity,
And Morrison ruled that they choose Kansas City.
'Twas thus firmly settled for all time to come,
Central station men vote and supply men are dumb.

KANSAS CITY AND CAPE MAY, 1890, PROVIDENCE AND MONTREAL, 1891, AND BUFFALO, 1892.

At Kansas City the Mayor welcomed the "exponents of the most powerful force of nature," who immediately exercised their energy in the discussion of the insurance question in its relation to electric lighting. Numerous excellent reports from committees were presented, and a valuable paper on "Construction of Central Stations," by Mr. C. J. H. Woodbury, of Boston, was read. Mr. George H. Babcock told the members about "The Economical Generation of Steam for Electric Light Stations" in an instructive manner. Other papers were read by C. J. Field, T. Carpenter Smith, M. D. Law, E. F. Peck and Professor Elihu Thomson. Resolutions on the death of Miles W. Goodyear and C. McIntire were adopted. Mr. Marsden J. Perry, of Providence, was elected president. The "Application of Electricity to Street Railways," by Mr. Frank J. Sprague, was most favorably received. The most remarkable feature of this Convention was the fact that the constitution was not amended. This oversight was at once remedied by a new amendment presented at the Cape May meeting. The usual programme of papers, reports and discussions was successfully accomplished at this Summer resort. Congress was memorialized in regard to giving the electrical industries proper recognition in the United States census. Sea baths, music and dancing were enjoyable features. An electrical exhibition in a separate hall especially marked the meeting at Providence. After the usual excellent programme of papers was disposed of, a reception was tendered the Association by the citizens of Providence, headed by Governor Ladd, of Rhode Island, and President Marsden J. Perry. A dance and supper, given by the American Electrical Works, was another pleasant social feature of the meeting. Mr. Charles R. Huntley, of Buffalo, was elected president. The meeting at Montreal was a particularly fine social event, Sir Donald Smith and Prof. H. T. Bovey, of McGill University, contributing largely to the social functions. A banquet was given at the Windsor Hotel, at which Lord Stanley, Governor-General of Canada, delivered an address. The electrical exhibition, under the management of Gen C. H. Barney, was the largest and finest of its kind ever held in this country. World's Fair matters were presented by Special Commissioner J. Allen Hornsby, and the Association appointed a World's Fair Committee to represent its interests. The Committee on Constitution presented suggested amendments. The ELECTRICAL REVIEW celebrated its tenth birthday, which occurred during the Buffalo meeting, by printing the finest special issue ever produced by an electrical publication. A lively and interesting meeting was held. The papers were unusually good, Mr. William Stanley, Jr.'s, on "Alternating Current Motors," and its discussion by Mr. L. B. Stilwell and others, being of great interest. Resolutions on the death of Mr. George Worthington, offered by Mr. Geo. M. Phelps, were adopted and ordered engrossed, and a copy sent to the family of the deceased. Prof. Elisha Gray reported on the World's Congress Auxiliary to be held during the World's Fair, and stated that electrical engineering would have a prominent part. It was informally decided that hereafter the Association hold but one meeting a year. The presence of the famous humorist, Marshall P. Wilder, as a guest of the Okonite Company, added cheer to the ceremonies, which concluded with a banquet. Mr. James I. Ayer was elected president for the ensuing year. The constitution was amended and the record was still safe.

ST. LOUIS-ON-THE-MISSISSIPPI, 1893.

Westward again the light of empires took its way,
And listened to a good address by Chairman James I. A.
The feature of this meeting was the lecture on the light
From currents of high tension, by Tesla, genius bright.

Other papers of importance were read, discussed and filed,
And Townley's address on glow lamps stirred up a ruction mild.
Professor Weston then went in to tell a thing or two
On incandescent lamps, which he was qualified to do.

The stopper lamp was here brought out to view the light of day,
And Townley said he thought this lamp had really come to stay.
Then Smith from Philadelphia made a speech both blunt and strong,
He named the lamps constructed right, and those that were built wrong.

This proved to be the light that lit the fuse upon the bomb,
But ere the thing began to flash or dangerous become,
It was decided to postpone until some other day
Discussion on this question and—to fight some other way.

L'ENVOI.

If, as we've sung our little song
(Though oft' the meter may be wrong),
You've "reminisced"—once cracked a smile,
The effort has been worth our while.

THE BARD.

Storage Battery Litigation Postponed.

The Brush Electric Company and the Consolidated Electric Storage Company as co-complainants, have sued the Electric Storage Battery Company and W. W. Gibbs, president (manufacturers of the chloride accumulator), for infringement in the United States Circuit Court. The suit is brought on the Brush storage battery patents, recently sustained by the United States Circuit Court of Appeals, more especially patent No. 337,269. The motion for a preliminary injunction was to have been heard before Judge Green at Trenton, N. J., on February 20, but the hearing has been postponed to April 3.

An Electro-Oxy-Hydrogen Blow-Pipe.

H. N. Warren, in the *Chemical News* for January 19, 1894, describes a new form of oxy-hydrogen blow-pipe in which the gases are obtained directly from the electric decomposition of water. The water is decomposed in a U-tube, as in the familiar laboratory experiment, and the gases rise directly into the blow-pipe, where they mix. Thus the action is perfectly automatic, and of almost indefinite duration ; no taps are required, the gases are in the exact proportions required by theory and the flame may be regulated by increasing or decreasing the decomposing electric current.

Fennville, Mich., has given a franchise for electric lighting to an Allegan firm. Fennville requires four arc lights for street illumination.

The Improved Sechrist Automatic Switch.

The Central Electric Company, of Chicago, are introducing to the eastern and central trade the Sechrist automatic switch, a new method of controlling electric lights. This system was invented by Albert Sechrist, of Denver, Colorado, about 10 years ago, although at that time Mr. Sechrist only used a single push button to operate the switch. This method was not considered practical to introduce on the market, having the same objection that all single push button, commutation or mechanical switches have; that is, the confusion arising from trying to operate the lights from more than one point, a person not being able to tell whether the light to be controlled is "on" or "off," unless the switch is located in the same room with the light itself, which is not always desirable.

About two years ago Mr. Sechrist decided to adopt the automatic gas keys with the white and black pearl buttons to control his automatic switch, and at once set to work experimenting to perfect his invention and make it a practical success. Besides his own patent, he has purchased valuable patents covering broadly the use of the automatic switch system in the United States and several of the foreign countries.

During the past year Mr. Sechrist has not only introduced his automatic switches in practical operation in over 100 residences in Denver alone, but has also established agencies in nearly all of the large cities in the United States, from nearly all of which he has valuable testimonials as to the practical success of the new system.

The system is especially adapted for controlling incandescent lights in private residences, and in that capacity alone gives a great range of possibilities for convenience and comfort, besides being adapted for a number of other uses, among which are the controlling of electric lights and bells for railway signaling, etc. Its advantages in connection with residence lighting, for which it was especially designed, are claimed to be as follows:

1. In regard to its appearance. Fig. 1 shows a six button plate controlling three automatic switches. The metal plate, finished to match the hardware with white and black pearl buttons, is really an ornament and certainly satisfactory so far as appearance goes, which is one of the most important features in residence work. Or, instead of being collected on a metal plate, the buttons may be small pearl or ivory set in the casings of the doors as in Fig. 2. The automatic switch, shown in Fig. 3, is located in some out-of the-way place where it cannot be seen, as it requires no attention whatever.

2. With reference to its convenience. By means of this system a person may have absolute control of any or all of the lights in the house from any part of the house. That is, a person in moving about a house in any direction is always able to turn on the light ahead, and at the same time turn off the lights from that part of the house which he has just left, never having to pass through a hall or room in the dark. This is often a great convenience. A person coming home at night presses a button outside, which turns on the porch light, enabling him to readily unlock the front door. Immediately on opening the door, the hall, parlor, library or dining room lights may be turned on or off. The hall lights may be turned on or off from either the first or second stories, and also from each chamber. Conveniently located beside the bed is another set of buttons, and by simply touching this or that button one is able to turn on or off all the lights in the house. In like manner buttons may be located throughout the entire house to suit the convenience of the owner. By having buttons conveniently arranged less light is required, and the electric light bills are thereby greatly reduced, without any inconvenience to the occupants of the house. Quite a convenient and novel scheme was recently introduced in a Denver residence. The wires from an automatic switch controlling the cellar lights were attached to the cellar steps, so that a person going down cellar and returning, automatically turns on and off the cellar lights, much to the satisfaction of the owner, who found that it made quite a difference in the electric light bills at the end of the month, as he had been annoyed considerably before by the absent-mindedness of the servant girl in forgetting to turn off the cellar lights when they were not needed. The small bell wires which run to the various push buttons may be readily attached to the doors and windows of the house, the mere act of opening which will turn on or off the lights, or the wires may be attached to an electric mat concealed under a rug or carpet, and the light will be automatically turned on or off as may be desired. The latter is more applicable, especially as a burglar alarm.

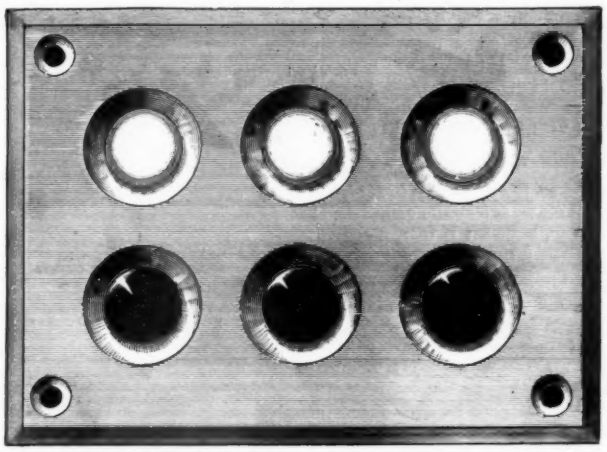
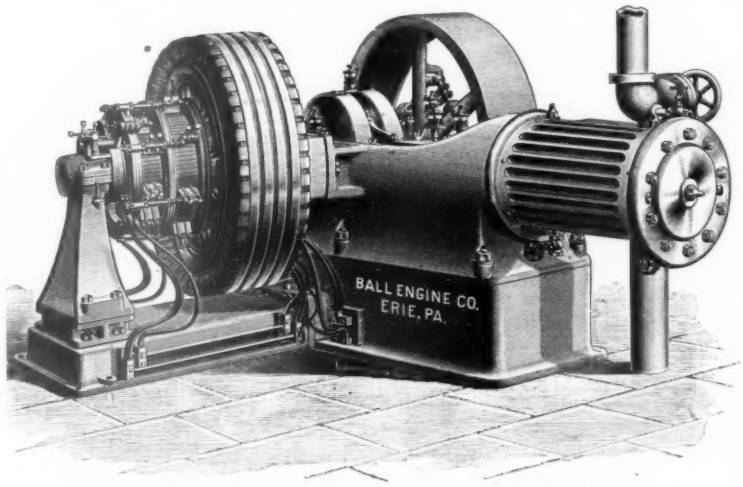


FIG. 1.—SIX BUTTON PLATE CONTROLLING THREE SECHRIST AUTOMATIC SWITCHES.



DIRECT-CONNECTED BALL ENGINE AND WADDELL-ENTZ DYNAMO.

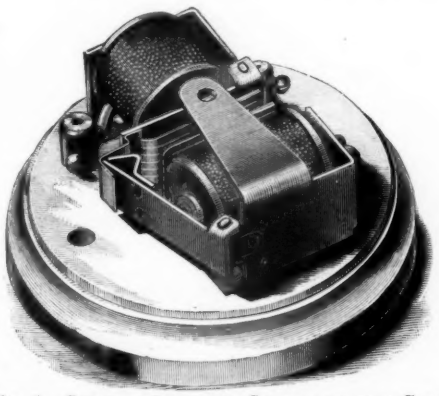


FIG. 3.—SECHRIST AUTOMATIC SWITCH, WITHOUT COVER.

3. In regard to its construction and simplicity. The automatic switch itself, shown in Fig. 3, is very simple in construction, being simply a locking and releasing device, operated by means of two electro magnets. There are no adjusting screws or complicated parts to get out of order. The electric circuit is attached to the automatic switch the same as to any common switch, while the wires from the magnet spools, which are common bell wires, run to the different push buttons from where the switch is to be controlled. The Sechrist automatic switch may be operated with either an ordinary battery or by means of the electric light current. In using the electric light current to operate the switches, Mr. Sechrist prefers to reduce the electric light current, through a resistance box, to the strength of an ordinary battery. This makes the system absolutely safe and more reliable than the battery. The method of running the wires and connecting them to the automatic switch may be readily understood by referring to Fig. 4. A A represent the back of the automatic switch; B a group of lights to be controlled; S an ordinary switch loop connected to the automatic switch; *a*, *b* are wires supplying the reduced current to operate the automatic switch; *b*, *c*, *d* are ordinary bell wires which run to the different push buttons from where it is desired to control the lights; C, D are two sets of buttons controlling the automatic switch A A. It is evident that any number of push buttons may be connected to the wires *b*, *c* and *d*. One resistance box may be used to supply current for any number of automatic switches. All switch loops should be of the same polarity. To operate the switch by means of a battery, instead of the electric light current, substitute a battery in place of R.

Where there are several automatic switches in the same house, different colors of bell wires may be used, representing the different automatic switches. In this way the wiring is very simple and easy.

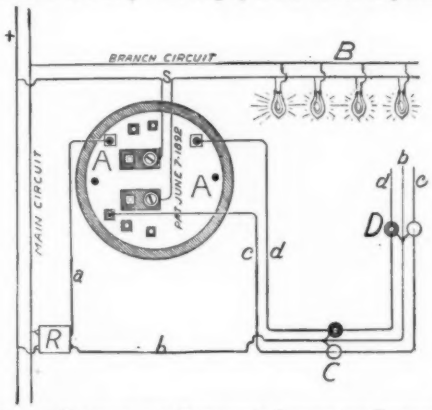


FIG. 4.—WIRING DIAGRAM FOR SECHRIST'S AUTOMATIC SWITCH SYSTEM.

A Direct-Connected Ball Engine.

The progress towards the ultimate perfection of electrical machinery is manifested in many ways, but in no way more clearly than in the present use of engines directly connected to dynamos. This arrangement of engine and dynamo has a two fold advantage: The first of these is the small floor space occupied. This is an important consideration for central stations, hotels and office buildings in large cities where there is a steadily increasing demand for economy in this direction. Another advantage is in the elimination of wastes of energy by transmission through belts and counter shafting. With the direct-connected engine the frictional losses due to outside causes entirely disappear, leaving nothing but the internal friction of the engine to be accounted for.

The Ball Engine Company, of Erie, Pa., has made a number of installations in connection with various types of dynamos, among late ones two 200 horse-power cross-compound engines, directly connected to Siemens & Halske dynamo in the Lumber Exchange Building, Minneapolis, Minn.; one 125 horse power simple engine, in connection with a Waddell Entz dynamo, in the store building of Willoughby, Hill & Company, Chicago; one 80 horse power engine, in connection with a Waddell-Entz dynamo, in the building of Cumner, Craig & Company, Boston, Mass.

The accompanying illustration represents an 80 horse-power Ball engine directly connected to a Waddell-Entz dynamo. It shows the armature mounted on the engine crank shaft, which is supported on the end by an out-board bearing resting on an extended sub-base. This is a remarkably compact, durable and efficient arrangement, and has given the greatest satisfaction in practice.

FIG. 2.—BUTTONS TO SET IN DOOR CASING.

The distinctive features claimed for this well-known engine are: beauty of design, simplicity and compactness, solidity and strength of frame, large bearings and wearing surfaces, excellence of materials and workmanship.

The engine, therefore, is economical and durable, and being perfectly balanced will run quietly and smoothly under the heaviest and widest varying loads. The regulation is said to be so perfect that the engine will not vary to exceed one per cent. in speed. Every detail of construction receives the most careful inspection, and every engine is thoroughly tested before shipment is made.

In the Supreme Court on the indictment against the city of Auburn, Me., for nuisance in allowing the horse railroad to keep open its track, the jury rendered a verdict of guilty. Judge Walton in his charge to the jury held as a matter of law the street railroad had no right to remove the snow from its tracks when by so doing the streets would be left in a dangerous condition.

Crocker-Wheeler Standard Multipolar Machines.

Since moving to their new works at Ampere, N. J., the Crocker-Wheeler Electric Company, of New York city, have been very busy perfecting a line of larger sizes of dynamos and motors, one type of which is illustrated herewith.

The detail of these motors and dynamos represents the work of the company's entire engineering staff during the past year. As will be readily seen by the illustrations, great care has been given to produce an artistic design, a solidity of construction, and a close adjustment of proportions electrically within the machine.

In the multipolar type illustrated, the steel magnets are turned to gauge and set

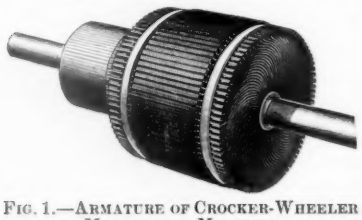
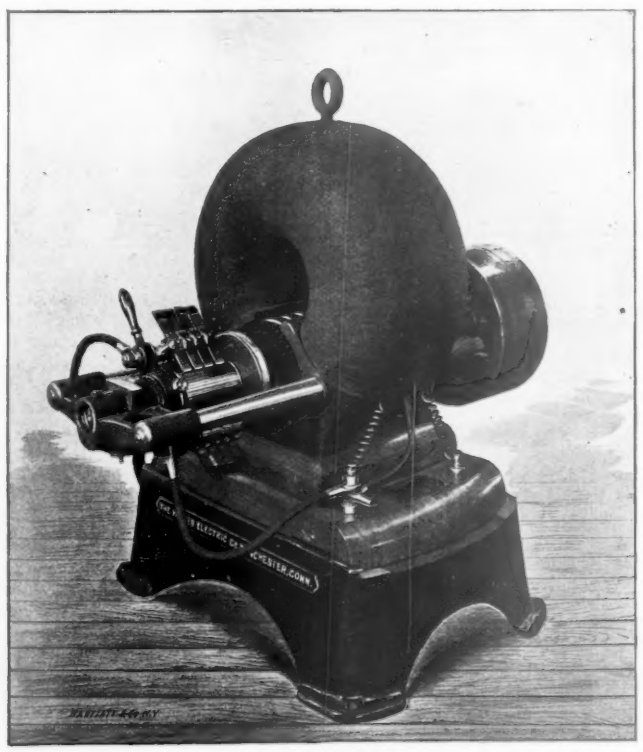


FIG. 1.—ARMATURE OF CROCKER-WHEELER MULTIPOLAR MACHINE.

into the yoke, the outer end of the holes for the fields being covered by a thin circular plate. The pillow block standards are cut in one piece with the base; the armature being accessible by removing the caps of bearings and the upper half of the magnet frame, thus permitting of the armature being lifted vertically out of the bearings, when the upper half of the magnet frame is thus removed. The rocker arm is made in halves, held together by wing nuts, and travels upon a grooved ring attached to the pillow block standard and slotted, the grooved ring being cut away through the upper side wide enough to permit the shaft to be lifted out. No solder is used in any part of these multipolar armature winding heretofore employed renders one portion of the armature liable to short circuit the other portion if there is any inequality in the strength of the fields. This construction is an improved form on that formerly followed by the Standard Electric Company, of St. Johnsbury, Vt., of whom the Crocker-Wheeler company are the successors in this business. This form of armature was the invention of Mr. C. S. Bradley, and was the prototype of all of the bar wound armatures now commonly made in large sizes, such as for railway generators, etc.

The new line of standard machines being brought out by the Crocker-Wheeler Electric Company are, as a matter of course, of high efficiency, but what is more important is the fact that the necessary losses are evenly distributed in the various parts of the machine, so that the heat produced by these losses may be evenly distributed, and thus permit the machines to stand the greatest abuse without any one part suffering in excess. This point of distribution of the efficiency losses seems to be the direction in which to look for improvement, and is a matter about which the engineers of this company are very wide awake. For the equipment of the modern industrial power plants this higher class of apparatus is particularly appropriate. One plant furnished by the Crocker-Wheeler company already amounts to about 500 horse-power in motors alone, with large additions being frequently made.



MATHER 500 LIGHT DYNAMO.

chines, and besides being built to stand 25 per cent. over-load without undue heating, it is said that they will stand an altogether unusual degree of heating without injury.

The multipolar types above 25 horse-power (20 kilowatts) for 110 volts, have armature conductors of rectangular copper bars riveted together by means of strip copper and connectors in place of the ordinary wire windings. The armatures thus wound, although for multipolar machines, have but two circuits, and may, therefore, be operated with one set of brushes instead of two sets, because of the novel cross-connection within the armature. The common practice in multi-ranging from 50 to 1,200 lights, the larger machines having slotted armatures.

A large number of these machines are already in use. An extensive installation may be seen in daily use in the new *Herald* building in this city, supplying both light and power.

The Mather Dynamo.

The dynamo illustrated on this page is for 450 to 500 lights, 125 volts, compound wound, speed 900 revolutions. All these machines have cast-steel fields, which are said to give higher efficiency, besides reducing the size and weight as compared with iron fields. The machines are made in sizes

The Citizens' Street Railway Company, of Kalamazoo, Mich., brought suit against the American Employers' Liability Insurance Company, of New Jersey, for $5,000. Last July they paid $2,100 premium on $25,000 insurance, and canceled it in November, but have been unable to recover the unearned premium; hence the suit.

Questions and Answers.

BY OUR "QUESTION EDITOR."

STARTING ALTERNATING DYNAMOS.

TO THE EDITOR OF ELECTRICAL REVIEW:

In starting up an alternating light dynamo, can the engine be started slowly, the brushes placed upon the commutator and the switches thrown in, and then allow the dynamo to pick up slowly, or is it best to start up and have the machinery going at full speed before throwing in the switches?

Yours very truly,

H. E. M.

Sunbury, Pa., February 9, 1894.

If there are not two or more dynamos paralleled in circuit, it does not matter much how you start. I believe the most general practice for a single machine on the circuit is to set brushes, close switches and start engine up by degress. The advantage is in avoiding damage by short circuits, if any have developed since the last shut-down, as the current rises slowly and gives time for observation. If several dynamos feed the circuit in parallel, it is usual to get up speed and adjust the pressure to standard before closing the main switch.

The New Bergmann Alternating Arc Lamp.

One of the principal goals for which the electrical inventor during the last few years has been striving is a successful alternating current arc lamp for incandescent circuits. The final establishment of the alternating current incandescent arc lamp at an early date as the most economical means of first-class illumination is confidently looked for by many people. The new Bergmann alternating current lamp now being put on the market by the General Incandescent Arc Light Company, of New York, will, it is expected, prove a long step forward toward this realization, so important both to the public and electric illuminating companies.

As in the case of its direct current lamp, this company manufactures its alternating current incandescent arc lamps in various styles and degrees of ornamentation, from the plainest so-called "Standard" lamp, which is itself sightly in appearance and neat in design, to the most elaborate creations of the metal worker's art.

The illustrations on this page show two of these latter, but the black and white cuts give no really adequate idea of the attractive form of these fixtures, which must be seen in the reality to be properly appreciated.

The company's handsome illustrated circular No. 7, which can be obtained by mail, gives a fuller account of the claims made for its lamp than we can of course reproduce in these columns, but some of them may be briefly stated as follows:

Simplicity of mechanism, first-class workmanship, absolute steadiness without adjustments, ease of trimming, protection from dust and weather, starting at less than the normal current, requiring no waste of current in resistance, large range of candle-power, improved carbon holders, etc.

The company is prepared to send the lamp on trial to any responsible intending purchaser, and as it has thus brought it, by means of these columns, to the notice of all who are interested at the time of the Electric Light Convention in Washington, no doubt it will experience a marked rush for orders and inquiries about these lamps, which we understand it will also have on exhibition during the Convention.

The company will be represented at the Convention by its general sales agent, Mr. S. A. Douglas, who will, of course, be pleased to go into the details and show all the excellence and beauties of its incandescent arc lamps to his numerous friends who may be present.

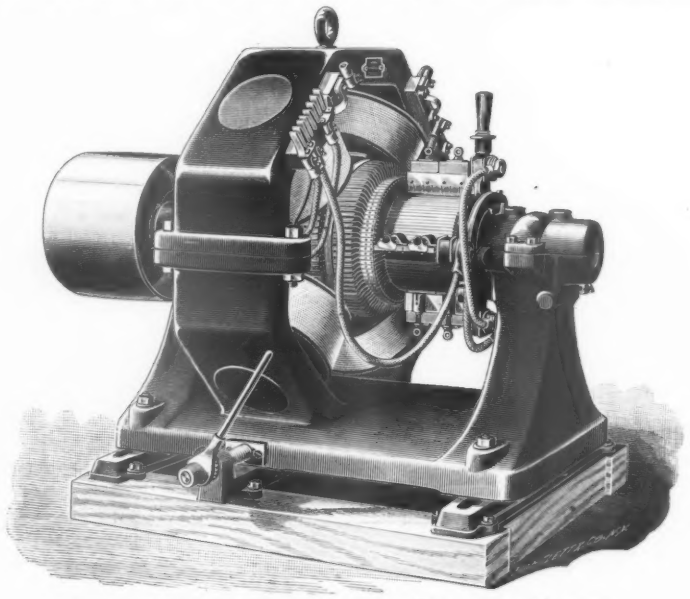
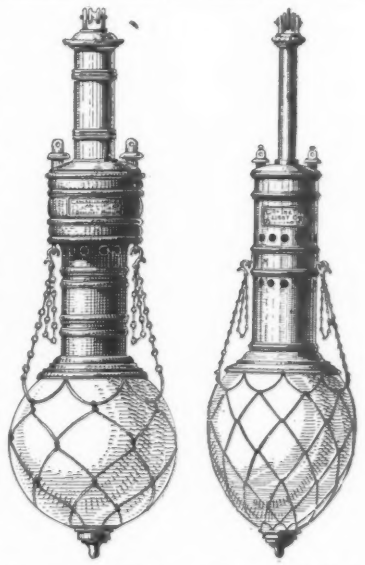


FIG. 2.—CROCKER-WHEELER STANDARD MULTIPOLAR MACHINE.

The Snow-Plow Man.

Now is the time when the gentle snow-flake in numbers makes glad the heart of the snow-plow man. As he sits in his office watching the struggling pedestrians in the street below, pushing half-blinded through the ever accumulating drifts, his mind wanders to fields yet unconquered. He



ORNAMENTAL TYPES OF BERGMANN'S NEW ALTERNATING CURRENT ARC LAMP.

thinks of new devices and he lets his imagination run riot among untried ideas. He wonders, all elements taken into consideration, whether the plow or the revolving brush will be best adapted to the wants of his customers, the street railway men. The brush seems more practical. It will clear a comparatively thick coating of ice, and, moreover, it sweeps clean. A simple plow is never advised for use in a city, but on snow-drifts, which so often delay trains in the West, the brush is entirely inadequate. We should feel somewhat more reconciled to blizzards when we recognize that there are some whose hearts are gladdened.

A New Electrical System of Signaling for Steam Railways.

A new and very important departure in railroad signaling is made by the device which we illustrate herewith, the object being to supersede the block system in use at present, and at a much smaller cost, both in equipment and maintenance, afford absolute safety to railroad trains. The invention in detail is as follows:

Between the rails in the center and running parallel with them is a timber or

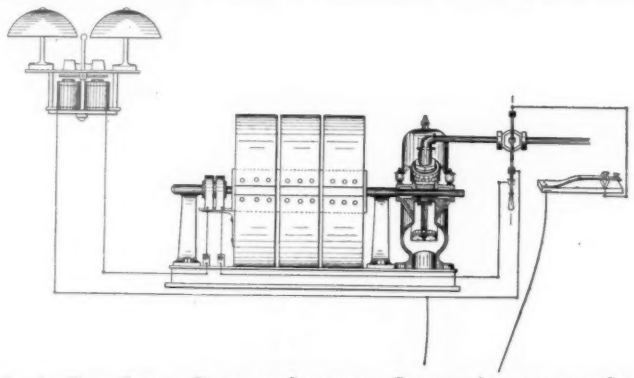


FIG. 1.—A NEW STEAM RAILWAY SIGNALING SYSTEM—ALTERNATING CURRENT GENERATOR AND MOTOR COMBINED, INCLUDING BELL, STEAM VALVE, LEVER, AND KEY FOR COMMUNICATING BETWEEN TRAINS.

stringer, six inches wide and the height of the rails. This stringer is bolted securely to the ties. On the top of the stringer is bolted two bars of flat steel, two inches wide and one-quarter inch thick, leaving a space of two inches between the steel bars. These steel bars are used as a conductor to carry

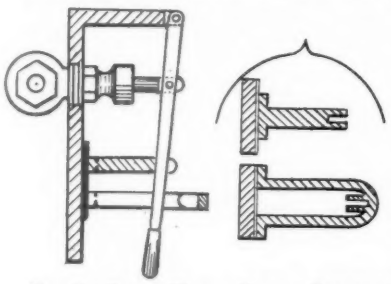


FIG. 2.—STEAM VALVE LEVER, SHOWING SWITCH CONNECTIONS FOR OPENING AND CLOSING THE CIRCUIT AUTOMATICALLY.

the electric current. Each conductor is broken at intervals of one mile, or whatever distance railroad officials deem necessary to insure absolute safety to trains. These breaks occur alternately, so that if the maximum danger limit is one mile the minimum can never be less than one-half mile. The current used in signaling is generated by a small alternating current generator, combined with a small rotary steam motor placed on a shelf in the cab, the space occupied by both being less than 12 inches. This rotary motor is driven by direct steam from the locomotive boiler through a small pipe, and after entering the motor is reduced to a jet one-sixteenth of an inch in diameter. With

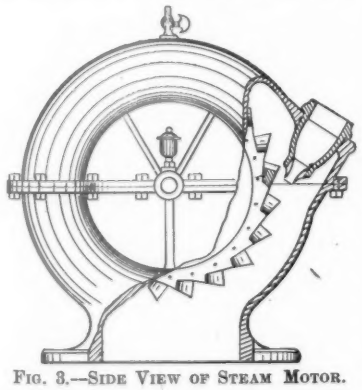


FIG. 3.—SIDE VIEW OF STEAM MOTOR.

the boiler pressure the motor will furnish one-eighth horse power. The motor shaft continues through and forms the armature shaft of the generator. The motor and generator being driven by direct steam from the boiler, are consequently running whether the engine is in motion or not.

Electrical connections are made from one side of the generator to the metal of the locomotive in several places, thus conveying the current to the rails. From the other side of the generator wiring is carried to a bracket which supports a steel wire brush. This brush is six inches wide, two feet in diameter with steel wire three-thirty-seconds of an inch thick. It is journaled in a suspension bracket, which is insulated from the metal of the engine and located either under the pilot or the tender, directly over and coming in contact with the conductor between the rails. In the cab between the motor and boiler is a lever which opens and closes a valve, thus controlling the steam for the motor. There is also in the cab a heavy gong connected in the circuit with the generator for the purpose of signaling danger. When two engines are in the same block or danger distance, the circuit is thus completed and the bell rings in each cab.

Every switch is electrically connected, so that when a switch is set wrong it will signal an approaching train at a danger distance. The connections are made by contact points in the top of the switch stand.

Gongs are operated at grade crossings without the aid of accompanying batteries,

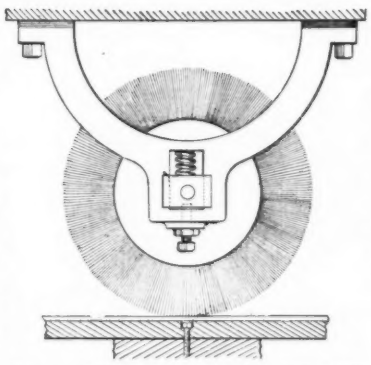


FIG. 4.—SIDE VIEW OF BRUSH AND INSULATED BRACKET—BRUSH TWO FEET IN DIAMETER.

and when a train gets within a mile or any distance desired, the gong at the crossing is kept continuously striking until the train has passed.

Draw bridges are electrically connected, so that in case the draw is open or the bridge burned or damaged in any way, the bell automatically rings in the cab of an approaching engine, so that the engineer is warned when his train is within the danger distance.

For service on freight trains the caboose is equipped with a brush suspended from the center of the car, and when a train breaks apart the brush is dropped to the center conductor, thus short-circuiting, and notifying the engineer that his train is broken apart, and also notifying the engineer of any approaching train or section, if within the block, that danger is ahead.

If a train leaves the rail, all that is necessary to warn an approaching train from either direction within the block is to place a crow-bar or some other good conducting medium from the central conductor across to the rail, thus giving the signal in the cab of any approaching locomotive.

At all sidings the conductor is laid in close proximity to one of the rails, and to a point at which a car will clear the main line. Should a car hang over and not clear the main line the flange of the wheel makes contact with the conductor, therefore, short-

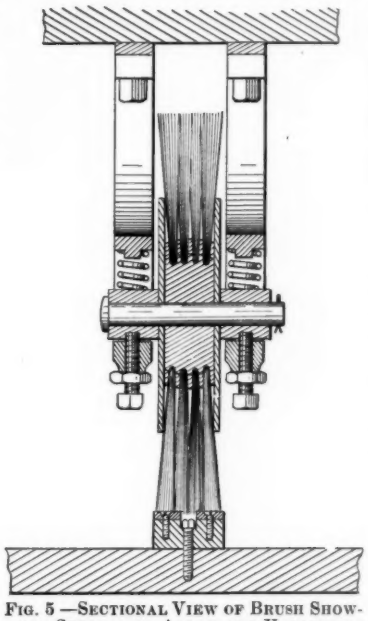


FIG. 5.—SECTIONAL VIEW OF BRUSH SHOWING SPRINGS TO ALLOW FOR VARIATIONS IN ROAD-BED AND ADJUSTING SCREWS TO REGULATE CONTACT WITH CENTRAL CONDUCTOR.

circuiting through the wheel, the conductor and rail, and giving the alarm of danger to any approaching main line train when within the danger distance.

This system absolutely discards the use of batteries which are the important factor of all other systems. The one generator located in the cab performs the work of the

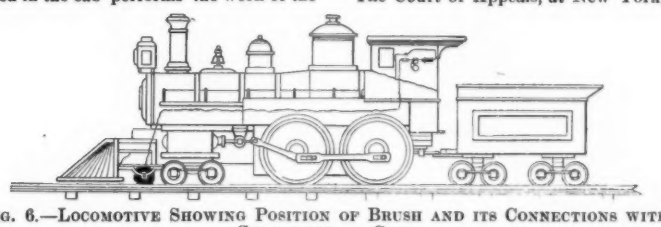


FIG. 6.—LOCOMOTIVE SHOWING POSITION OF BRUSH AND ITS CONNECTIONS WITH GENERATOR IN CAB.

many thousand sets of batteries distributed along the road-bed.

A telegraph key is placed in the cab connected with the circuit, and when two trains come upon the same block, by communication each engineer is informed in which direction his danger lies. This is accomplished by opening and closing the circuit, and with the simple fire alarm code announces the number of his train.

The invention is the work of Geo. E. Miller, who is a mechanical and electrical engineer of wide experience, and for a number of years connected with the Thomson-Houston Electric Company. The system is fully protected by United States letters patents, and is owned and controlled by the American Electric Train and Switch Signal Company, 53 State street, Boston, Mass. The company has made arrangements to equip a division of road in New England, and in 90 days the system will be in full operation and a practical demonstration given to the public. Should the system prove practicable, as all railroad and electrical experts say it must, the question of vision will be entirely eliminated, and so long as the engineer's hearing is all right, he can boom along through the fog, smoke, snowstorms, darkness, tunnels and around curves, satisfied that no ordinary dangers are ahead of him.

Opening of the Midwinter Fair at San Francisco.

January 27, 1894, a beautiful day was the one on which the opening of the Midwinter Fair was celebrated. Everything seemed propitious, and there can be little doubt but that it will be a success in every way. Things in general will not be on such a grand scale as in the World's Fair, but this we could not expect. Still the California Fair will come out a good second. Opening addresses were made by James D. Phelan, Governor Markam and Director-General M. H. de Young. Mrs. de Young, dressed in all the splendor permitted by a California Winter, pressed her gloved finger on the button, which, in turn, started the mechanism, similar to that which put the wheels in motion at the opening of the World's Fair.

Among the electrical exhibitors are the Western Electric Company, who have a very handsome showing. Next to this company's machines stand those of the Thomson-Houston Electric Company, of San Francisco.

The south gallery of the Building of Mechanical Arts has been reserved as a sort of electrical work-room, and is full of interest to the visitor. Men are constantly at work here on various electrical appliances, and all are welcome to see and learn what they can of the wonderful current which plays so important a part in the Exposition. Much credit is due to Mr. M. H. de Young, who has worked heart and soul to make the Exposition the success that it is. In his capacity of director-general he did more than a man's work towards bringing the Midwinter Fair to a successful issue.

An Important Tax Decision.

The Court of Appeals, at New York, on February 9, handed down an order reversing the decisions of the General and Special Terms in the case of People *vs.* Edison General Electric Company.

This decision is important, not only as affecting a large sum of money, but in the principle which it involves. The case was as follows:

In 1892 the Edison General Electric Company brought suit to set aside their assess-

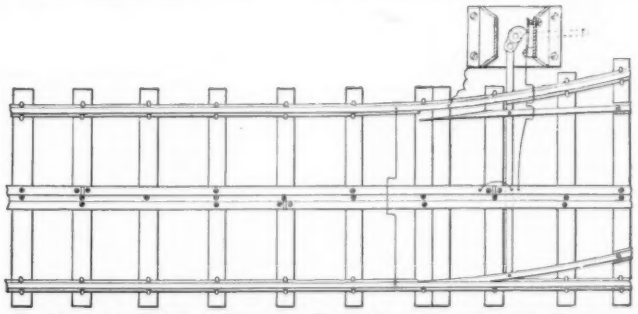


FIG. 7.—ROAD-BED SHOWING CENTRAL CONDUCTOR, ALTERNATELY BROKEN, AND CONNECTIONS FOR LOCATING A MISPLACED SWITCH.—(See Next Page for Other Illustrations.)

ment for taxation. In the lists they were appraised as being worth $2,670,700, and the tax was levied on that amount. They set up a claim that their chief assets consisted of patent rights and other non-taxable property, asserting that their tangible assets were less than their liabilities, so they really had no property subject to taxation.

In Special Term it was held that nothing in the records showed the assessments to be unjust, and the General Term held the same opinion, so the case was carried to the Court of Appeals, which, by reversing the former decisions, gives the victory to the electric company.

ADVANCE INFORMATION.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

Electric Light and Power.

GAINESVILLE, TEX.—The Merchants' Electric Light and Power Company; capital, $25,000.

CHICAGO, ILL.—Acme Lighting Company, of Chicago; capital, $15,000. Incorporators, John J. Arney, M. G. Armstrong and Thomas S. Jackson.

CHICAGO, ILL.—Western Automatic Light Company; capital, $500,000. Incorporators, William J. Stapleton, Ed. S. Clark and Maud Freeman.

ABINGDON, ILL.—Abingdon Electric Company; capital, $12,500; to operate an electric light plant. Incorporators, C. C. Travis, Annie J. Travis and C. D. Warner.

ASSUMPTION, ILL.—An electric light company has been formed here and will immediately instal a plant.

CHICAGO, ILL.—Louis K. Comstock Company; capital, $20,000; general electric engineering and construction. Incorporators, Louis A. Comstock, Frederick S. Richmond and Paul V. Cary.

New Telephone Companies.

DENVER, COL.—The Western Slope Telephone and Supply Company, by William Clark, Charles Williams and Charles Keene, with $5,000 capital to operate in Grand Junction.

SOUTHAMPTON, L. I.—The Long Island Telephone Company to operate a telephone system on long Island. The route is to be between New York city and Montauk Point and Orient Point. The trustees for the first year are William A. Corwith, Willis D. Van Brunt, James H. Bishop, Carrie H. Bishop, Laura E. Van Brunt, Jennie Wicks and Carrie L. Corwith, all of the village of Southampton.

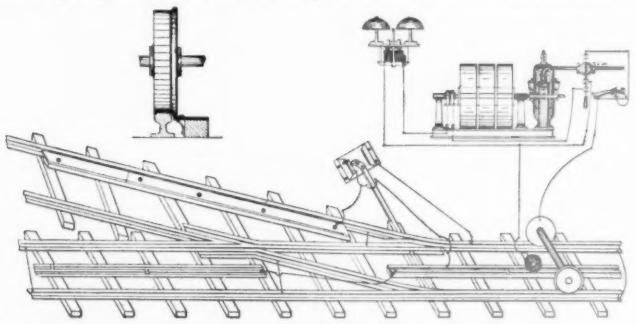


FIG. 8.—SIDE TRACK CONNECTIONS FOR LOCATING A CAR THAT OVERHANGS OR DOES NOT CLEAR THE MAIN LINE.—(See page 107.)

Increase of Capital.

HARTFORD, CONN.—The Connecticut Dynamo and Motor Company has increased its capital from $6,000 to $8,500, and the number of shares from 120 to 170. The increase has been paid in cash.

Business Troubles.

NEW YORK CITY.—Judgment for $7,898 was entered on February 14 against the Electrical Wonder Company, of London, in favor of Joseph Livingston, on a note dated March 4, 1893.

BOSTON, MASS.—In the United States Circuit Court, on February 16, William M. Osborne was appointed receiver for the New England Printing Telegraph Company on complaint of William F. Fitzgerald, one of the stockholders. The bill filed by Fitzgerald alleges that the company is in debt to the extent of $50,000. Judge Aldrich ordered that Mr. Osborne furnish $10,000 bonds by February 21.

BRIDGEPORT, MASS.—Judge G. W. Wheeler on February 17 appointed Montgomery Waddell, president of the Waddell-Entz Electric Company, permanent receiver, no opposition being made to the application of Jose A. Machado. Mr. Waddell said the liabilities of the company are $130,000 and the assets about $60,000, besides $90,000 in machinery. Of the $60,000 about one-half is in outstanding bills. Mr. Waddell qualified in $20,000 bonds. It is said that the embarrassment of the company is only temporary.

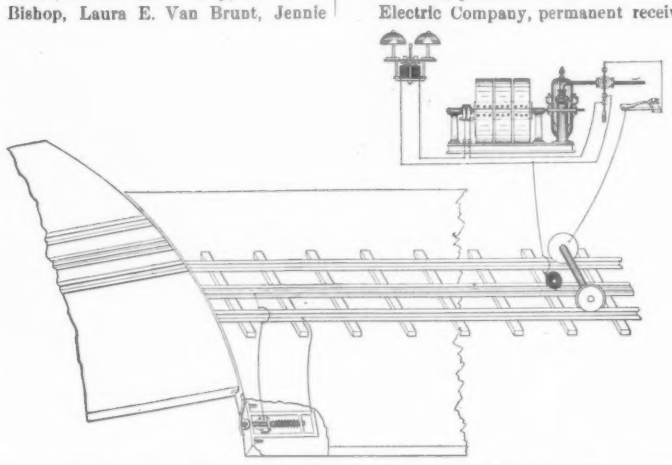


FIG. 9.—DRAWBRIDGE, SHOWING METHOD OF CLOSING THE CIRCUIT, THUS GIVING WARNING TO APPROACHING TRAINS, WHEN IMPASSABLE.—(See page 107.)

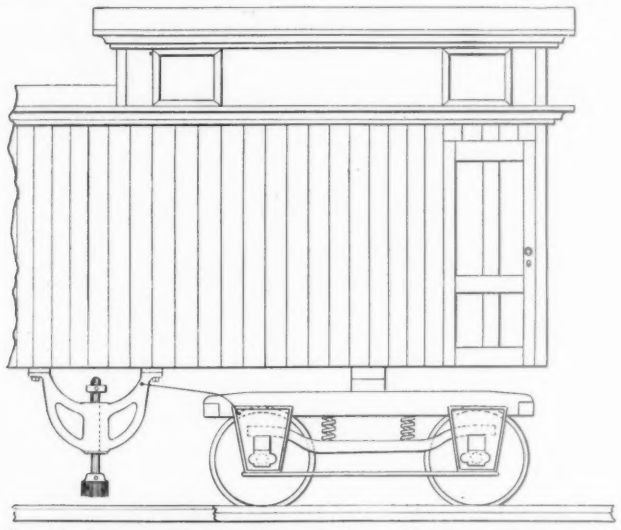


FIG. 10.—POSITION OF BRUSH LOCATED UNDER CABOOSE.—(See page 107.)

New Electric Railways.

NEW YORK CITY.—A mortgage of $175,000, executed by the Union Electric Railway Company, of Saratoga Springs, N. Y., to the Central Trust Company, of New York, has been recorded in the Saratoga County Clerk's Office. Its object is to secure the payment of 350 bonds of $500 each, based on a loan obtained further to develop its plant.

ROCKFORD, ILL.—Rock River Electric Railway Company, with a capital of $50,000, to build a road from Rockford to Dixon. The papers are signed by James S. Ticknor, George E. King and Harry B. Andrews, of Rockford; Jason C. Ayres, of Dixon, and Fred. G. Jones, of Oregon. James S. Ticknor, of Rockford, general manager of the West End Electric Railway Company, of Rockford, is the leading spirit in the enterprise.

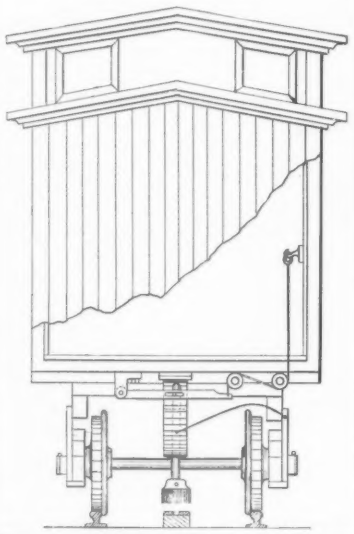


FIG. 11.—SECTIONAL VIEW OF CABOOSE SHOWING METHOD OF CONNECTING BRUSH WITH CENTRAL CONDUCTOR WHEN TRAIN BREAKS APART.—(See page 107.)

HARRISBURG, PA.—The Lackawanna Valley Street Passenger Railroad Company, in Lackawanna County; capital, $100,000.

QUINCY, MICH.—There is a scheme on foot to connect this city and Coldwater by an electric railway.

LEWISTON, ME.—It is announced that E. E. Proctor, of Wakefield, Mass., has purchased a controlling interest in the Lewiston and Auburn Horse Railway. Electric cars will be put on in June. The officers of the new corporation are as follows: Directors, E. W. Gross, S. S. Hersey, Auburn; H. C. Little, Lewiston; E. E. Proctor, C. F. Woodford, Wakefield, Mass. Treasurer and general manager, E. W. Gross.

INDIANAPOLIS, IND.—The Farmers' and Broad Ripple Street Railway Company; capital, $100,000. The directors are Capt. W. R. Myers, Judge John C. Green, A. N. Fisher, Henry Malpas and O. C. Myers.

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